

**Results of the 2005 TMDL monitoring for Diazinon and Chlorpyrifos in
California's Central Valley Waterways**

January - February 2005

Henry J. Calanchini

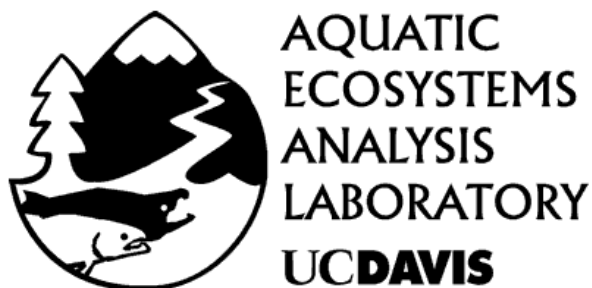
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Introduction

This report describes the pesticide monitoring results, including the loads of diazinon and chlorpyrifos, at nineteen locations (Figures 1-3, [Table 1a](#)) in fifteen waterways of California's Central Valley associated with runoff events that occurred in January and February 2005. The monitoring was conducted by the Aquatic Ecosystems Analysis Laboratory (AEAL) of the John Muir Institute of the Environment, University of California, Davis, as authorized under Contract No. 02-210-150 from the Central Valley Regional Water Quality Control Board (CVRWQCB). For the purposes of this report a "storm event" is defined as the period of time encompassed by sample collection, and over which pesticide loads were assumed to have occurred.

Objective

The primary objective of this project was to monitor nineteen selected sites in the Sacramento and San Joaquin River Basins, and the Sacramento-San Joaquin Delta over two winter storm events during the 2004-2005 orchard dormant spray season to further characterize and define the sources and presence of diazinon, chlorpyrifos and other pesticides. The results of this study will be used to support the development and implementation of the Total Maximum Daily Loads (TMDLs) for diazinon and chlorpyrifos in the Sacramento and Feather Rivers, the Sacramento-San Joaquin Delta Waterways, and the San Joaquin River.

Monitoring Overview

In the Sacramento Basin, six sites were monitored once daily, for eleven to twelve days each, over the course of two consecutive storm events from 15-26 February 2005 ([Figure 1](#), [Tables 1a, b](#)). In the San Joaquin Basin six sites were monitored either once or twice per day during two separate storm events: 27-30 January and 15-18 February 2005 ([Figure 2](#), [Tables 1a, b](#)). In the Delta seven sites were monitored once daily during and following one storm event from 15-19 February 2005 ([Figure 3](#), [Tables 1a, b](#)).

The measured field parameters included pH, water temperature, electrical conductivity (EC), and stream discharge at non-tidally influenced and non-gauged sites. All water samples were delivered to the California Department of Food and Agriculture

(CDFA) laboratory in Sacramento, California for chemical analysis using gas chromatography-mass spectrometry (GCMS).

The CDFA laboratory analyzed for 12 chemical compounds in each water sample ([Table 3](#)). The detection frequency, concentrations and calculated instantaneous loads for diazinon and chlorpyrifos are presented in this report. The chemical analysis results for all compounds, water quality parameters measured in the field, and stream discharge data are presented in tabular format in the Appendices.

Figure 1. The six sampling sites in the Sacramento Basin monitored for organophosphate pesticides during the orchard dormant spray season 2004-05.

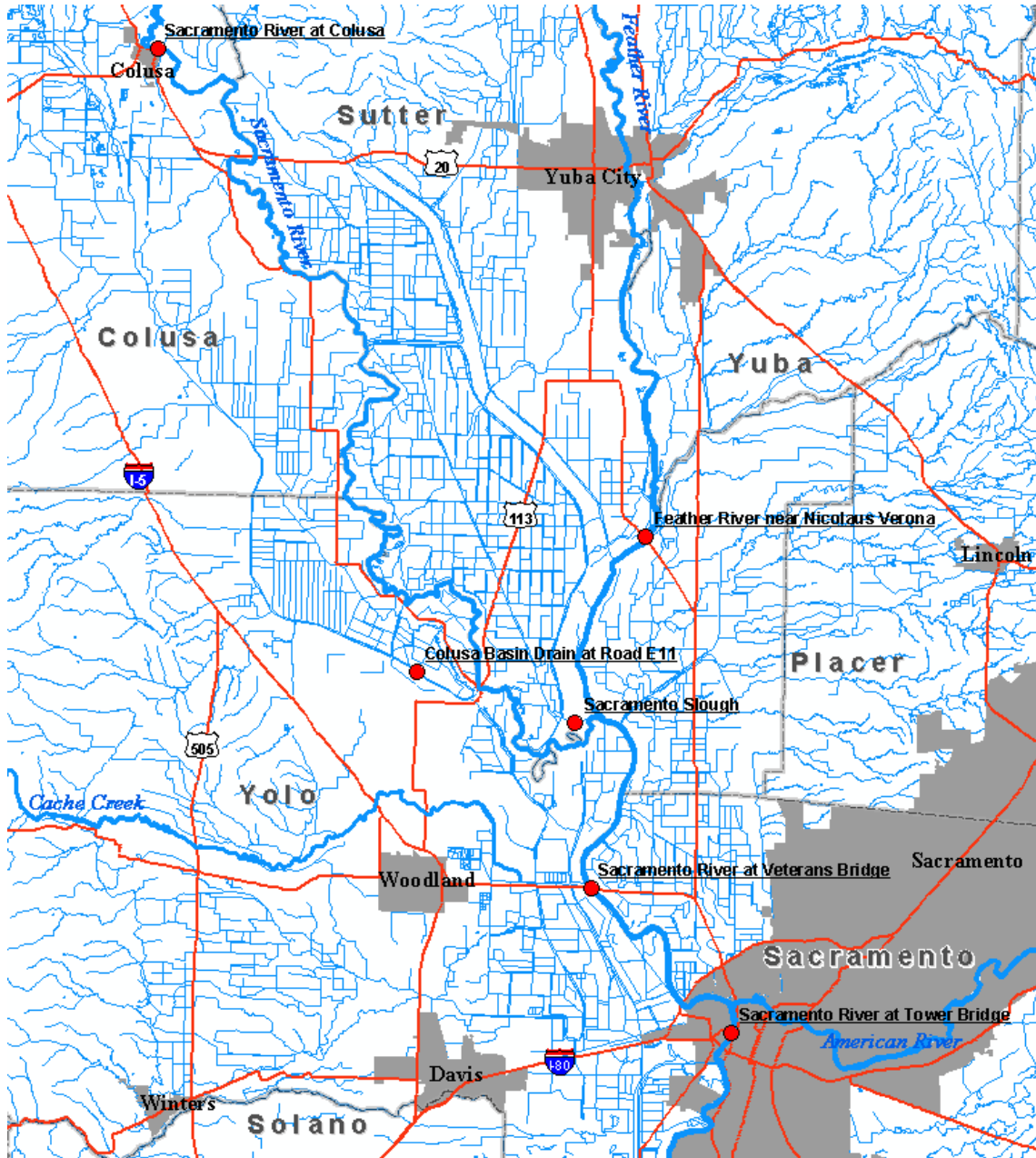


Figure 2. The six sampling sites in the San Joaquin Basin monitored for organophosphate pesticides during the orchard dormant spray season 2004-05.

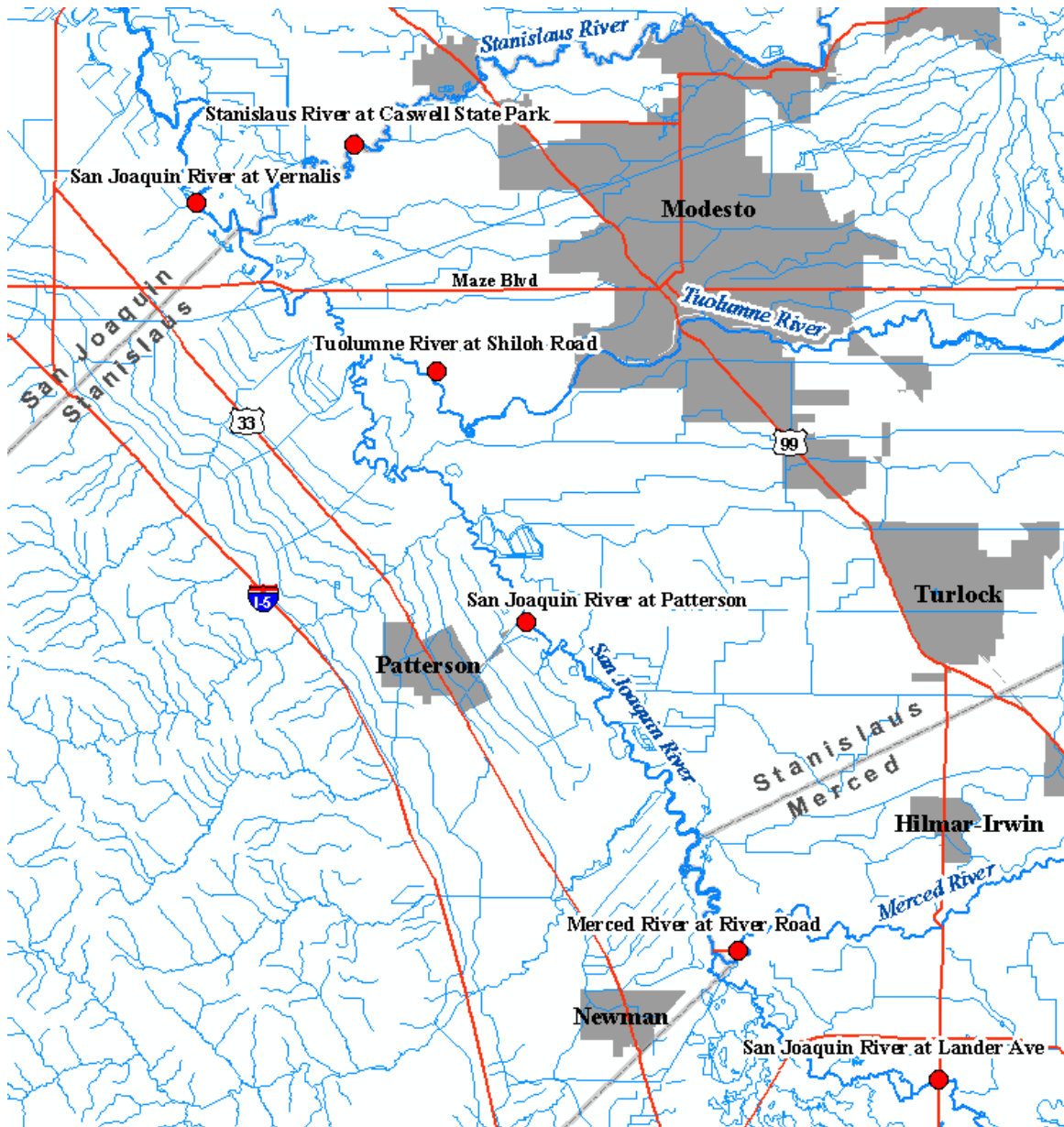


Figure 3. The seven sampling sites in the Sacramento – San Joaquin Delta monitored for organophosphate pesticides during the orchard dormant spray season 2004-05.

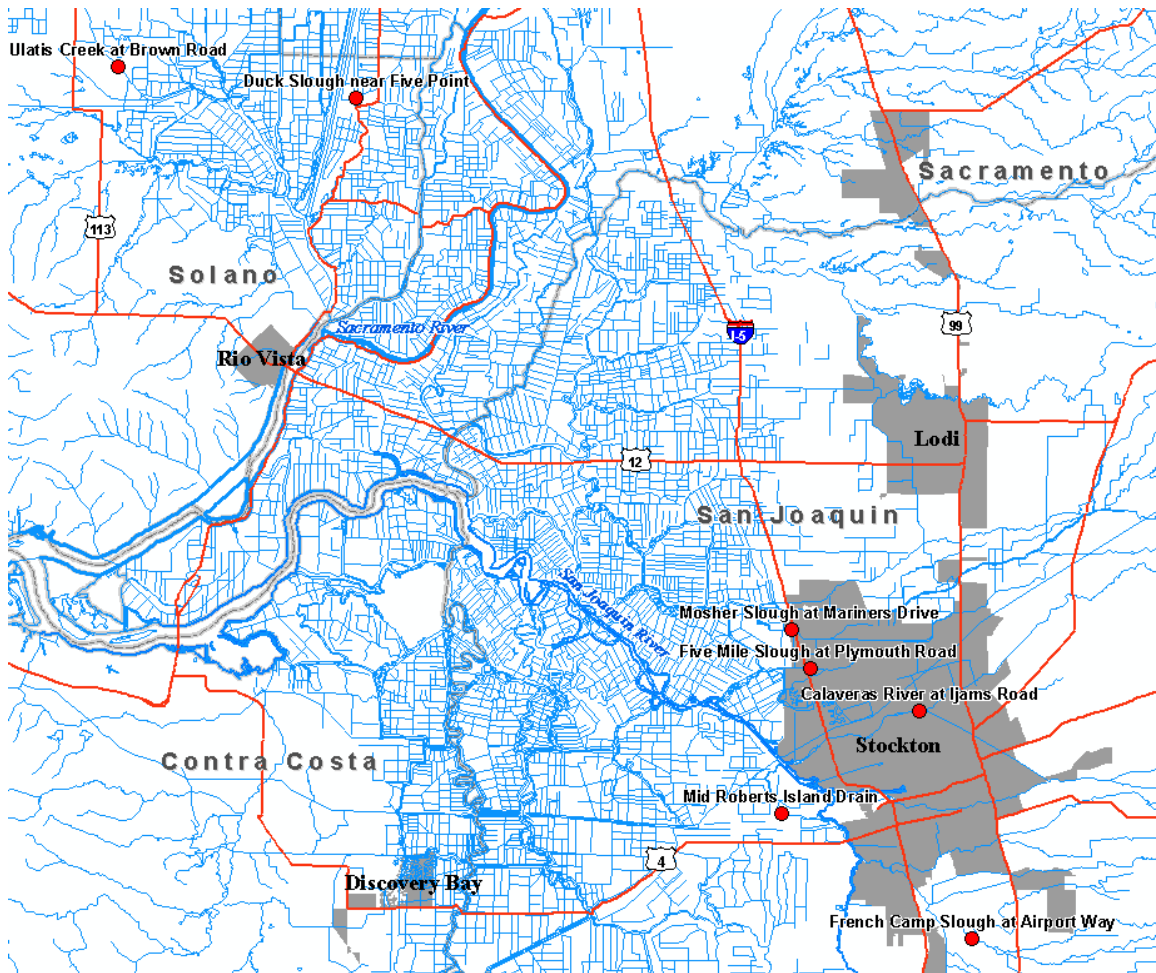


Table 1a. Sampling sites and locations.

Sacramento Sampling Sites	Latitude	Longitude
Colusa Basin Drain near Knights Landing	38.8123	-121.7733
Sacramento River at Veterans Bridge	38.6734	-121.6255
Feather River near Nicolaus / Verona	38.8980	-121.5915
Sacramento River at Tower Bridge	38.5805	-121.5084
Sacramento River at Colusa	39.2146	-121.9994
Sacramento Slough near Karnak	38.7807	-121.6409
Delta Sampling Sites	Latitude	Longitude
Mosher Slough at Mariner's Drive	38.0327	-121.3639
Five-mile Slough at Plymouth Road	38.0139	-121.3514
Calaveras River at Ijams Road	37.9938	-121.2825
Mid-Roberts Island Drain	37.9417	-121.3683
French Camp Slough at Airport Way	37.8811	-121.2480
Ulatis Creek at Brown Road	38.3069	-121.7938
Duck Slough near Five Points Marina	38.2931	-121.6435
San Joaquin River Basin Sampling Sites	Latitude	Longitude
San Joaquin River at Vernalis	37.6758	-121.2639
Stanislaus River at Caswell State Park	37.7021	-121.1772
Tuolumne River at Shiloh Road	37.6031	-121.1305
San Joaquin River at Lander Avenue	37.2952	-120.8503
San Joaquin River at Patterson	37.4940	-121.0795
Merced River at River Road	37.3506	-120.9609

Table 1b. Sampling sites, scheduled sampling frequency for each storm event and actual storm event sampling dates for the Sacramento, Delta and San Joaquin sampling sites.

Sacramento Basin Sites	Scheduled sampling frequency	Actual storm event sampling dates
Colusa Basin Drain near Knights Landing	1 sample/day x 7 days	Feb 15 – Feb 25, 2005
Sacramento River at Veterans Bridge	1 sample/day x 8 days	Feb 16 – Feb 25, 2005
Feather River near Nicolaus / Verona	1 sample/day x 7 days	Feb 16 – Feb 25, 2005
Sacramento River at Tower Bridge	1 sample/day x 8 days	Feb 15 – Feb 26, 2005
Sacramento River at Colusa	1 sample/day x 7 days	Feb 15 – Feb 25, 2005
Sacramento Slough near Karnak	1 sample/day x 8 days	Feb 16 – Feb 26, 2005
Delta Sites	Scheduled sampling frequency	Actual storm event sampling dates
Mosher Slough at Mariner's Drive	1 sample/day x 5 days	Feb 15 – Feb 19, 2005
Five-mile Slough at Plymouth Road	1 sample/day x 5 days	Feb 15 – Feb 19, 2005
Calaveras River at Ijams Road	1 sample/day x 5 days	Feb 15 – Feb 19, 2005
Mid-Roberts Island Drain	1 sample/day x 5 days	Feb 15 – Feb 19, 2005
French Camp Slough at Airport Way	1 sample/day x 5 days	Feb 15 – Feb 19, 2005
Ulati Creek at Brown Road	1 sample/day x 5 days	Feb 15 – Feb 19, 2005
Duck Slough near Five Points Marina	1 sample/day x 5 days	Feb 15 – Feb 19, 2005
San Joaquin River Basin Sites	Scheduled sampling frequency	Actual storm event sampling dates
San Joaquin River at Vernalis	twice daily x 4 days; storm events 1-3	Jan 27-30; Feb 15-18, 2005
Stanislaus River at Caswell State Park	twice daily x 4 days; storm events 1-3	Jan 27-30; Feb 15-18, 2005
Tuolumne River at Shiloh Road	twice daily x 4 days; storm events 1-3	Jan 27-30; Feb 15-18, 2005
San Joaquin River at Lander Avenue	once daily x 4 days; storm event 1	Jan 27-30, 2005
San Joaquin River at Patterson	once daily x 4 days; storm events 2-3	Feb 15-18, 2005
Merced River at River Road	once daily x 4 days; storm events 1-3	Jan 27-30; Feb 15-18, 2005

Sample Collection Methods

All samples were collected by one of the following three methods: grab, integrated grab and equal-width-increment (EWI). The collection method used for each site is shown in [Table 2](#). Detailed procedures for sample collection and handling are listed in [Appendices 3a](#), [3b](#), and [3c](#) of the quality assurance project plan (QAPP) (Calanchini, 2005).

Grab samples were collected by harnessing a 1-liter amber glass bottle into a pole sampler and dipping the bottle into the stream as close to the center of the channel as possible.

Integrated grab samples were collected by lowering a 3-liter PTFE (polytetrafluoroethylene) bottle, strapped in a weighted cage, from a bridge at three equally spaced verticals. At each vertical the bottle was filled approximately $\frac{1}{4}$ full. The composite sample was then thoroughly agitated and poured into a 1-liter amber glass sample bottle. The PTFE bottles were used at all sites to minimize loss of pesticide due to sorption to container walls.

EWI samples were collected at 6-10 equally spaced points across the channel width with a D-77 depth integrating sampler using the equal-width-increment method (Shelton, 1994). The water from each point (vertical) was mixed in a stainless steel churn, thoroughly agitated then poured into the 1-L glass sample bottle.

At each Sacramento site an additional sample was collected in a 250ml amber glass bottle at the same time that the primary sample was collected and using the same methods. These additional samples were analyzed for diazinon on a daily basis using Enzyme-Linked Immunosorbent Assay (ELISA). The ELISA analysis provided an inexpensive screen for diazinon and was used to determine if scheduled sampling should be continued based on the observed presence of diazinon. ELISA screening began for samples collected on 15 February and continued through the 24 February samples due to their results indicating the continued presence of diazinon at all sites on each day ([Appendix 2](#)).

In the Delta all samples were collected by the grab method described above.

In the San Joaquin Basin all samples were collected with a 3-liter PTFE bottle using the methods outlined above.

Immediately after collection, sample bottles were placed on ice and delivered to the California Department of Food and Agriculture (CDFA) Center for Analytical Chemistry in Sacramento. Samples were usually delivered on the same day and no later than 48 hours after collection.

Precipitation During the Study

The following summary includes rain gage data obtained through the website www.weatherunderground.com and weather updates from State Climatologist Bill Mork.

Two storm events were sampled in the northern San Joaquin Basin, one storm event was sampled in the Delta Basin and two consecutive storm events were sampled in the Sacramento Basin.

In the Sacramento Basin four weather-monitoring stations were used: Red Bluff and Sacramento representing precipitation in the Sacramento River Basin; and Oroville and Marysville, representing precipitation in the Feather River Basin. In the San Joaquin Valley, a weather monitoring station located in downtown Modesto was used to record rainfall. In the Delta basin, two weather-monitoring stations were used: Stockton and Fairfield.

The first storm event sampled in the San Joaquin region was preceded by a dry period of 14 days, and began on 26 January with 0.41" of rain recorded in Modesto, another 0.01" on 27 January and 0.69" on 28 January ([Figure 4](#)). Sampling commenced on 27 January and continued for a period of four days. This storm event was characterized as a progressive Pacific upper air pattern that brought precipitation in a series of weather systems to Northern California (Mork, personal communication). This storm event would also have been sampled in the Sacramento and Delta regions in order to capture dormant spray runoff, however sampling in those areas was delayed pending approval of the Quality Assurance Project Plan (QAPP) for that monitoring.

A second major storm event began on 14 February and was preceded by a 15 to 17 day dry period throughout the northern Central Valley. Sampling began in all three study regions on 15 February. This storm event was characterized by a broad subtropical flow bringing moisture from the south, northward across California, with the Jet Stream providing additional impulses of shortwave energy that produced recurring periods of precipitation throughout the study regions (Mork, personal communication).

In the San Joaquin Basin the second storm event began on 14 February with 0.16" of rain, increasing to 1.1" on 15 February, and dropping another 0.16" on 16 February

([Figure 4](#)). Sampling in the San Joaquin Basin commenced on 15 February and continued for a period of four days.

In the Delta, on 14 February, 0.28” and 0.23” of rain fell in Stockton and Fairfield, respectively. On 15 February, these amounts increased to 0.75” (Stockton) and 1.43” (Fairfield), with precipitation decreasing to less than 0.3” at both locations on each of the following two days ([Figure 5](#)). Sampling began in the Delta on 15 February and continued for a period of four days.

In the Sacramento Valley on 13 February in Red Bluff, 0.47” of rain fell. On 15 February rain fell at all monitoring stations and ranged from 0.16” at Oroville to 0.7” at Sacramento ([Figure 6](#)).

Over the next seven days rain continued to fall. On 16 February precipitation amounted to 0.54” at Marysville and 0.37” at Oroville. During 17-18 February, precipitation decreased significantly, until 19 February when all stations recorded rainfall with values ranging from 0.22” at Sacramento to 0.61” at Red Bluff. Significant rain fell again on 21 February with 0.48” at Oroville and 0.42” at Marysville ([Figure 6](#)). As a result of these continuing precipitation events, sampling in the Sacramento Basin was extended past the original eight-day schedule and concluded on 26 February, a period of 12 days.

Figure 4. Rainfall at Modesto, California during the 2004-05 dormant spray season.

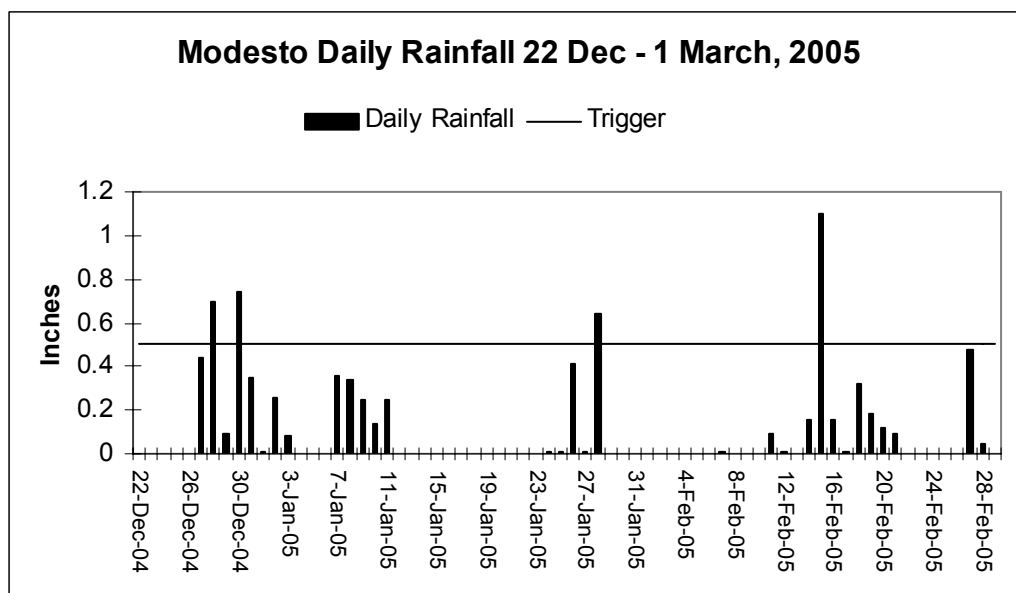


Figure 5. Rainfall at Stockton and Fairfield, California during the 2004-05 dormant spray season.

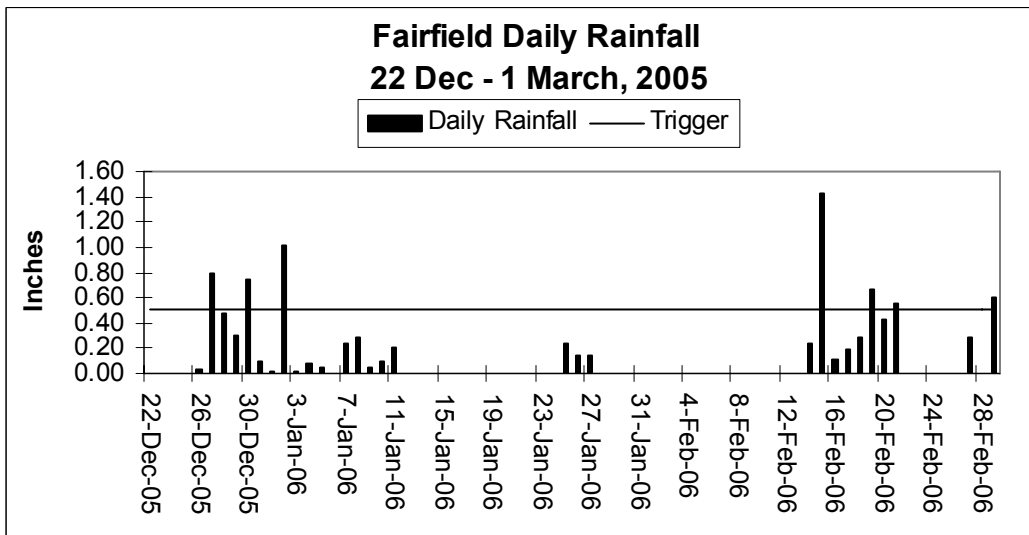
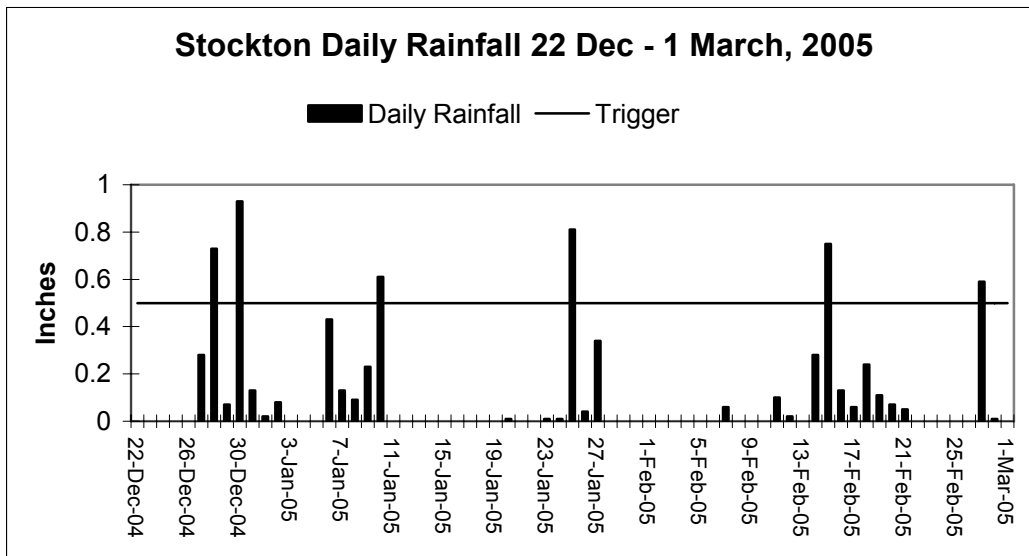
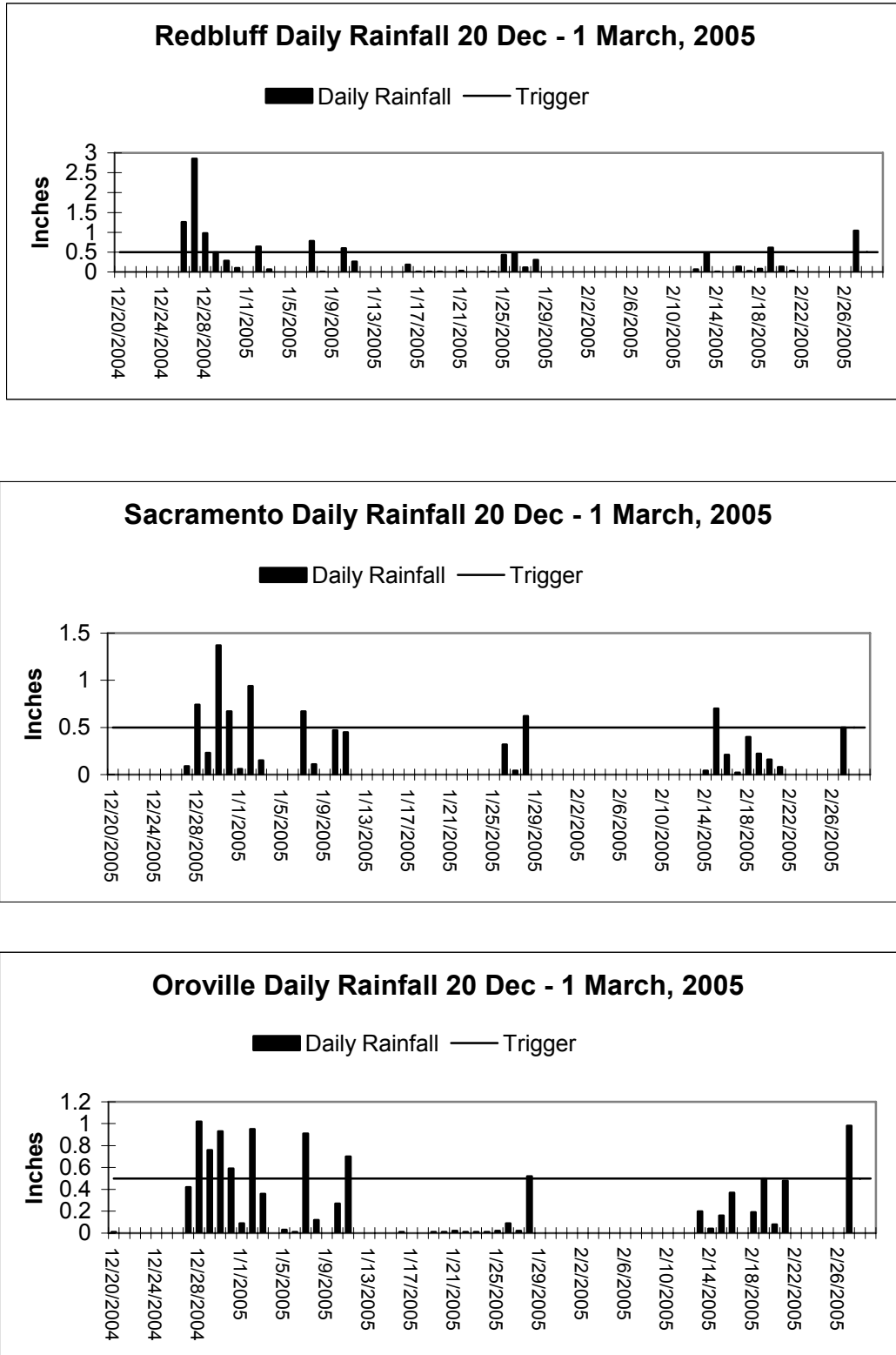


Figure 6. Rainfall at Red Bluff, Sacramento, Marysville and Oroville, California during the 2004-05 dormant spray season.



Quality Control Samples

Quality control (QC) samples were collected at the rate of 15 QCs for every 100 environmental samples as specified in Element 14 of the quality assurance project plan (Calanchini, 2005). Quality control samples included field duplicates, field blanks, equipment blanks, and matrix spikes.

All field duplicate samples collected in the Delta and San Joaquin basins were split duplicates. In the Sacramento Basin both split duplicate and sequential duplicate samples were collected. Water collected for split duplicate samples using the 3-liter PTFE bottle was poured into two 1-liter bottles. Sequential duplicate samples were collected immediately after collecting the primary sample by repeating the method (3L PTFE or D77) used to collect the primary sample. For split duplicate samples collected using a 1-liter bottle, two bottles were attached to the pole sampler and filled at the same time.

Field blanks were filled with organic-free (deionized) water obtained from the AEAL laboratory. When using the 3-liter bottle for sampling, the cleaned bottle was filled with organic-free water, which was then poured into a 1-liter bottle as a field blank. When using the 1-liter bottle, a cleaned bottle was filled with the organic-free water directly.

The equipment blanks were collected one time only for each piece of sampling equipment (e.g. pole sampler, 3-liter PTFE bottle, stainless steel churn). The equipment was cleaned according to the standard cleaning procedure, as described in the QAPP (Calanchini, 2005), and then rinsed with organic-free water. The rinse water was collected in a 1-liter amber glass bottle for analysis.

The matrix spike samples were collected in the same manner as the split duplicate samples. The spike mixture was added to the matrix spike samples in the CDFA lab. All field samples, including QC samples, were placed into a cooler with ice to maintain the temperature at approximately 4°C during handling and transport to the lab. In general, samples were delivered to the lab on the sampling day. If the samples could not be transported to the lab on the sampling day they were stored in coolers with sufficient ice to maintain the sample preservation temperature and delivered to the lab on the following day. All samples were delivered under chain-of-custody (COC) protocol, as outlined in the QAPP.

Table 2. Sampling sites, sampling methods and source for determining discharge, Sacramento River Basin, California.

[ADCP =Acoustic Doppler Current Profiler; CDEC=California Data Exchange Center; EWI=Equal Width Increment; Integrated= integrated grab sample with 3L PTFE bottle; manual discharge measurements were made with Price Type AA current meter, sounding reel and bridgeboard]

Sacramento Sampling Sites	Sampling Method	Source of Discharge Data
Colusa Basin Drain near Knights Landing	Integrated (Bridge)	Manual discharge
Sacramento River at Veterans Bridge	EWI / Boat	ADCP or CDEC gage: VON
Feather River near Nicolaus / Verona	EWI / Boat	ADCP or CDEC gage: NIC
Sacramento River at Tower Bridge	EWI / Bridge	CDEC gage: IST
Sacramento River at Colusa	Integrated (Bridge)	CDEC gage: COL
Sacramento Slough	EWI / Boat	ADCP
Delta Sampling Sites	Sampling Method	Source of Discharge Data
Mosher Slough at Mariner's Drive	Grab/Bank	None
Five-mile Slough at Plymouth Road	Grab/Bank	None
Calaveras River at Ijams Road	Grab/Bank	Manual discharge
Mid-Roberts Island Drain	Grab/Bank	None
French Camp Slough at Airport Way	Grab/Bank	None
Ulatis Creek at Brown Road	Grab/Bank	Manual discharge
Duck Slough	Grab/Bank	None
San Joaquin River Basin Sampling Sites	Sampling Method	Source of Discharge Data
San Joaquin River at Vernalis	Integrated (Bridge)	CDEC gage: VNS
Stanislaus River at CSP	Grab/Bank	CDEC gage: RIP
Tuolumne River at Shilo Road	Integrated (Bridge)	USGS gage: 11290000
San Joaquin River at Lander Avenue	Grab/Bank	CDEC gage: SJS
San Joaquin River at Patterson	Grab/Bank	CDEC gage: SJP
Merced River at River Road	Integrated (Bridge)	CDEC gage: MST

Discharge Methods and Load Calculations

At the Sacramento River at Colusa discharge data were obtained from the USGS gage 11389500 located at the sampling site.

An Acoustic Doppler Current Profiler (ADCP) was used from a boat to measure discharge at the Feather River near Nicolaus and Sacramento Slough. Discharge for Sacramento River at Veterans Bridge was received from the USGS gage 11425500 in the Sacramento River near Verona, approximately 7.7 miles upstream of the sampling site. No tributaries enter the Sacramento River between the gage site and the sampling site. There are three major pumping stations between these sites; however they do not operate during the winter.

Discharge values for the Sacramento River at Tower Bridge were received from the USGS gage 11447500 located at the I Street Bridge, approximately 0.57 miles upstream of the Tower Bridge. There are no tributaries between these sites. For dates when gage 11447500 was below the rating table, and there were no discharge values available, data from the USGS gage 11447650 on the Sacramento River at Freeport, approximately 12.5 miles downstream of the I Street gage, were used to estimate discharge [Q_{IST}] at the Tower Bridge. The equation [Q_{IST}] = $0.8321x + 5264.3$, ($r^2=0.96$) expresses the relationship between the two gages during the study period and was developed using hourly discharge data ($n=457$) from between 29 December 2004 and 4 March 2005.

At Colusa Basin Drain discharge was measured in conjunction with water collection using a Price Type AA current meter and a USGS bridge board and sounding reel, following standard USGS current-meter methods (Nolan 2001).

In the Delta discharge was measured manually while wading at the Calaveras River and Ulatis Creek using a Swiffer Model 2100 current meter. During high flows a USGS bridgeboard and sounding reel were used in conjunction with the current meter. At French Camp Slough on Airport Way discharge estimates were obtained courtesy of John Tingle at the California Department of Water Resources (CDPR) from the CDPR gage located on site. At Duck Slough and Mid-Roberts Island samples were collected from pumping basins where it was not physically possible to measure discharge. No discharge measurements were made at Mosher Slough and Five-mile Slough. Both of these sites are tidally influenced, with thick mud deposits, making wading access impossible for discharge measurements.

In the San Joaquin Basin discharge data were obtained from gages listed on the California Data Exchange Center (CDEC) website (<http://cdec.water.ca.gov/>) and operated by the California Department of Water Resources and the USGS. The gages for

the San Joaquin River at Vernalis (VNS), Lander Avenue (SJS) and Patterson (SJP) are located at the sampling sites.

Discharge for the Stanislaus River at Caswell State Park was obtained from USGS gage 11303000 on the Stanislaus River near Ripon – approximately eight miles upstream of the sampling site. The CDEC data were used unadjusted from the Ripon station. The river flows through an urban area at Ripon and through several urban areas upstream of Ripon.

The CDEC gage MOD (Tuolumne River at Modesto) was used to obtain discharge measurements for the Tuolumne River at Shiloh Road sampling site. There are no other suitable gauges for making any kind of distance weighted hydrograph so the data were used as presented on the CDEC website. There are significant urban areas upstream including Modesto and Waterford.

Discharge data for the sampling site on the Merced River at River Road were obtained from the CDEC gage MST (Merced River at Stevinson) approximately 3.68 miles upstream. The discharge gauge elevation is 59 feet and the sample site elevation is 53 feet. The low gradient (6 feet over 3.68 miles) and the size of the river allow us to make the assumption that the river rises fairly uniformly under normal precipitation conditions, therefore, flow data were used unadjusted from the CDEC site. There is one semi-permanent stream between the sample site and the discharge gauge. Flows are unknown for this stream and were assumed to be negligible. The river flows through an urban area near Livingston about 20 miles upstream from the sample site.

Daily loading rates of diazinon and chlorpyrifos were calculated by multiplying the stream discharge at the time of sample collection with the measured concentrations of each pesticide times the number of seconds (86,400) in one day. Loading rates were only calculated when the pesticide concentration was above the limit of detection and a discharge estimate was available.

Laboratory Sample Preparation and Analysis Methods

Upon arrival at the CDFA laboratory, samples were weighed and recorded. Each sample was spiked with 500 μ L of surrogate spiking solution composed of 0.25 μ g/mL chlorpyrifos methyl. Matrix spikes were spiked with 500 μ L of appropriate spiking solution. Approximately 500ml of the sample was emptied into a 2-liter size separatory funnel. The sample bottle was weighed and recorded and approximately 10-15g of granular sodium chloride added. The sample was gently shaken to dissolve salt. The

following steps, listed in parentheses, were then repeated three times in succession: [60ml of methylene chloride were added and the sample was mixed thoroughly for three minutes. After mixing the sample was allowed to settle until the lower methylene chloride layer was completely separated from the above water layer. The organic fraction was filtered through a bed of granular anhydrous sodium sulfate (approx. 20g) into a 250ml round bottom flask]. The round bottom flask was then placed on a Rotavapor evaporator and the resultant sample evaporated to 5-7 ml at 40° C. The contents of the round bottom flask were then transferred to a 15ml collection tube. The round bottom flask was rinsed with 5ml of methylene chloride and the rinse was added to the collection tube. The 15ml collection tube was placed on the N-Evaporator with the water temperature set at 40° C and the sample was evaporated until just reaching dryness. The sample was removed from the evaporator and added to a test tube containing 0.5ml of methylene chloride and 5.0µL of 5.0µg/mL internal standard solution. The contents of the test tube were then mixed with a vortex and transferred into an autosampler vial. The vial was capped and stored in a -5° C freezer until ready for analysis.

Samples were analyzed with an Agilent Model 5973 GC-MSD using a HP-5MS or equivalent GC column. Analysis was performed in the selective ion-monitoring mode.

Twelve compounds were analyzed for each sample (Table 3). The reporting limits (RL) for diazinon and chlorpyrifos were 0.020 and 0.010 parts per billion (ppb), respectively. The detection limits (MDL) were 0.007 and 0.004 ppb for diazinon and chlorpyrifos, respectively (Table 3). The lab reported estimated values when the values were below the RL but above the MDL. To ensure the accuracy and precision of the sample analysis, lab spikes, blanks, and a surrogate standard (chlorpyrifos methyl) were used. If the recovery of a spike sample was out of the control range, the water sample was re-analyzed.

Table 3. CDFA laboratory method detection and reporting limits for select pesticides

Compound	Method Detection Limit (MDL in µg/L)	Reporting Limit (RL in µg/L)
Azinphos methyl	0.007	0.050
Bifenthrin	0.007	0.050
Carbaryl	0.007	0.020
Chlorpyrifos	0.004	0.010
Cyanazine	0.007	0.050
Dacthal (DCPA)	0.007	0.050
Diazinon	0.007	0.020
EPTC (Eptam)	0.020	0.050
Methidathion	0.010	0.030
Metolachlor	0.007	0.020
Propargite	0.150	0.500
Simazine	0.005	0.200

Results

A total of 164 primary samples ([Appendices 1a, b, c](#) & [Appendices 4a, b, c](#)) and 41 quality control (QC) samples ([Appendices 3a, b, c](#)) were collected and analyzed: 65 primary, 19 QC in the Sacramento Basin; 35 primary, 10 QC in the Delta; 64 primary, 12 QC in the San Joaquin Basin.

Primary samples

Concentrations of diazinon and chlorpyrifos in the Sacramento Basin ranged from below detection to 0.410 ppb of diazinon and 0.004 ppb of chlorpyrifos, at Sacramento Slough on 16 and 24 February 2005, respectively ([Appendices 1a, b, c](#)).

In the Sacramento Basin a second sample was collected at the same time as the primary sample and analyzed using Enzyme-Linked Immunosorbent Assay (ELISA). All samples analyzed with ELISA showed diazinon to be present. Almost one third (17 of 57) of the samples analyzed using both ELISA and GCMS showed no detection of diazinon using GCMS.

ELISA results ranged from 0.008 ppb in a sample from the Sacramento River at Colusa on 19 February to 0.410 ppb in a sample from Sacramento Slough on 20 February ([Appendix 2](#)). In every sample, the results obtained through ELISA analysis showed higher concentrations of diazinon present in the sample matrix than results obtained using GCMS on the corresponding environmental samples.

In the Delta, pesticide concentrations ranged from below detection to 0.460 ppb of diazinon at Ulatis Creek on 16 February, and 0.036 ppb of chlorpyrifos at Mosher Slough on 18 February.

In the San Joaquin Basin pesticide concentrations ranged from below detection to 0.57 ppb diazinon in the Tuolumne River at Shilo Road on 27 January and 0.054 ppb of chlorpyrifos in the Merced River at River Road on 30 January.

Other pesticides detected in samples were eptam, carbaryl, metolachlor, bifenthrin, cyanazine, dacthal, methidathion, and the herbicide simazine, which was detected in 74% of the Sacramento samples and 100% of the Delta and San Joaquin samples ([Appendices 4a, b, c](#)).

Field Quality Control Samples

The precision of data analysis was measured through a series of field duplicates (n=13) and matrix spike/matrix spike duplicates (n=7). The acceptable level of precision for diazinon and chlorpyrifos data from this project, as drafted in the QAPP, was a relative percent difference (RPD) of $\pm 25\%$ between duplicate samples, and $\pm 25\%$ between matrix spike and matrix spike duplicate samples.

All thirteen sets of duplicate samples had RPD's of less than 25% for diazinon. Twelve of the thirteen sets of duplicate samples had RPD's of less than 25% for chlorpyrifos ([Appendices 3a, b, c](#)). The relative percent difference (RPD) between environmental and duplicate sample concentrations of chlorpyrifos ranged from 0-46%. The RPD's between environmental and duplicate sample concentrations of diazinon ranged from 5-22%.

A duplicate sample collected on 2/17/2005 from the Calaveras River at Ijams Road had an RPD of 46%. This sample was scheduled to be collected as a spike but the analyzing laboratory failed to spike the sample prior to extraction. The sample should be viewed as a duplicate. The detections of chlorpyrifos in both the environmental and associated duplicate samples were below the reporting limit (RL) and therefore the high RPD between the samples should be viewed as a product of low analytical precision below the RL and not as having failed the QAO for precision.

Six of the seven sets of matrix spike and matrix spike duplicates had RPD's of less than 25% for diazinon. A matrix spike duplicate sample collected on 19 February 2005 from the Sacramento River at Veteran's Bridge had an RPD of 26%. All seven sets of matrix spike and matrix spike duplicates had an RPD of less than 25% for chlorpyrifos. The RPD's between matrix spikes and matrix spike duplicates ranged from 0-17% and 0-26% for chlorpyrifos and diazinon, respectively ([Appendices 3a, b, c](#)). The percent

recovery of chlorpyrifos and diazinon in the matrix spike samples ranged from 77-98%, and 82-121% respectively.

The matrix spike samples from the San Joaquin and Merced rivers on 27 and 30 January 2005, respectively, do not have corresponding matrix spike duplicates; the lab did not begin splitting matrix spike samples and analyzing a separate portion as a matrix spike duplicate until after the first sampled storm event in the San Joaquin Basin.

The data quality objective (DQO) for recovery of diazinon and chlorpyrifos in matrix spike and matrix spike duplicates was 70-130% for diazinon and 70-140% for chlorpyrifos. All spikes met the DQO for recovery. Recoveries ranged from 82-121% for diazinon and 77-98% for chlorpyrifos ([Appendices 3a, b, c](#)).

The DQO acceptance limits for analytes in both equipment blanks (n=4) and field blanks (n=8) were “less than the reporting limit” of 0.007 ppb diazinon and 0.004 ppb chlorpyrifos. No analytes were detected in any of the blanks. An equipment blank collected on 15 February in the Delta had a low (66%) surrogate recovery during analysis and was not re-analyzed due to a lab scheduling error.

Lab Quality Control Samples

A total of 14 pairs of lab blanks (LB) and lab control spikes (LCS) were analyzed; a rate of one per batch of samples. The DQO acceptance limits for recoveries were 80-125% for both LB and LCS samples.

Twelve of 14 lab blanks were within the acceptable limits of recovery (Appendix 5). A lab blank extracted on 22 February had low surrogate recovery (73%) due to an extraction error of not adding salt to the deionized water used to make the blank. However, all surrogate recoveries in the actual samples associated with the QC set were within the acceptance limits of 80-125%. A lab blank extracted on 22 February for a second batch of samples also had a low surrogate recovery (68%). The re-analysis gave similar results (66% recovery). The lab blank had no detected compounds above the lab limit of detection. The low recovery was probably due to loss during the concentration step of the extraction procedure.

Thirteen of 14 lab control spikes were with the acceptable limits of recovery ([Appendix 6](#)). An LCS extracted on 22 February had low surrogate recovery (66%) due to an extraction error of not adding salt to the deionized water used to make the blank. However, all surrogate recoveries in the actual samples associated with the QC set were within the acceptance limits of 80-125%.

Daily loading rates

Loading rates were only calculated when the pesticide concentration was above the method detection limit (MDL) and a discharge estimate was available. For all samples where pesticide concentrations were below the MDL the loading rate was assumed to be zero.

In the Sacramento Basin the highest calculated instantaneous loading rate for diazinon was 596 grams per day in the Sacramento River at Sacramento. The only calculated instantaneous loading rate for chlorpyrifos in the Sacramento Basin was 18 grams per day at Sacramento Slough on 24 February ([Appendix 1a](#)).

In the Delta the highest calculated instantaneous loading rates for both diazinon (1549 grams per day) and chlorpyrifos (40 grams per day) were in Ulatis Creek ([Appendix 1b](#)).

In the San Joaquin Basin the highest calculated daily loading rates for diazinon (766 grams per day) and chlorpyrifos (182 grams per day) were in the Tuolumne River at Shiloh Road and the San Joaquin River at Vernalis, respectively ([Appendix 1c](#)).

Assessment of Data Quality

The Quality Assurance Objectives (QAOs) are listed below in [Table 4](#).

Table 4. Field and Laboratory Quality Assurance (QA) Objectives.

Field QC	Frequency/Number	Acceptance Limits	Results (met QAO/total # of)
Equipment Blanks	One time per each piece of equipment for first event only	Less than Reporting Limit	4/4
Field Blanks	Approximately 5%	Less than Reporting Limit	8/8
Cooler Temperature	Measured by analyzing lab at time of delivery	$\leq 4^{\circ}\text{C}$	100%
Field Duplicate Pairs	20	RPD $\leq 25\%$	12/13
Laboratory QC	Frequency/Number	Acceptance Limits	
Method Blank (=Lab Blank)	1/batch	80-125% All target analytes below reporting limit	12/14
Instrument Blank	After any standards	All target analytes below reporting limit	100%
Matrix Spike	Approximately 5%	70-130 % diazinon; 70-140% chlorpyrifos	9/9
Matrix Spike Duplicate	Approximately 5%	70-130 % diazinon; 70-140% chlorpyrifos RPD $\leq 25\%$	7/7
Lab. Control Sample (=Lab Control Spike)	1/Batch	80-125%	13/14
Surrogates	In all samples and QC	80-125%	200/205
Internal Standards	All samples and standards	50 – 200 %	100%

Five of the 164 primary samples should be viewed as estimates, or biased low, because the surrogate recovery was outside of the QAPP acceptance limits (80-125%

recovery for accuracy; all five were below 80%. These data are considered usable but biased low.

Five of the 41 field QC samples (duplicates, blanks, equipment blanks, matrix spikes and matrix spike duplicates) did not meet one of the QAOs for accuracy or precision:

- A matrix spike and matrix spike duplicate collected from the Sacramento River at Veterans Bridge on 19 February 2005 had an RPD of 26%. These data are considered usable but of marginal precision.
- One of two samples collected from the Calaveras River on 17 February, that were scheduled as a matrix spike and matrix spike duplicate (but treated as field duplicates because the analytical lab failed to add spiking solution prior to extraction) had an RPD of 46% to the environmental sample. These data are considered usable but of marginal precision.
- An equipment blank collected on 15 February had low surrogate recovery (66%) and was not re-analyzed due to a laboratory scheduling error. No analytes were detected in the sample. The results are considered usable but of low accuracy.
- A field blank collected at French Camp Slough on 19 February had low surrogate recovery (74%) during analysis. The sample was diluted by mistake and reanalyzed. The undiluted sample was reanalyzed on 6 April 2005. The re-analyzed sample also had a low (62%) surrogate recovery. The results are considered usable but of low accuracy.

The overall objective for completeness of diazinon and chlorpyrifos data for this project, as described in the QAPP, was 90% for both laboratory and field measurements. Because all of the data are considered usable the achieved level of completeness for laboratory measurements was 100% ([Appendices 1a, b, c](#)). The achieved level of completeness for field measurements (temperature, electrical conductivity, and pH) was also 100%.

Sampling Schedule Notes

A blank quality control sample scheduled for the Feather River site on the 13th day of sampling was instead collected on the 10th day because of the modified sampling schedule. A spike scheduled for the Colusa Basin Drain site on 25 February 2005 was instead mistakenly collected at the Sacramento River at Colusa site.

Results for Paired Samples Collected with Two Different Sampling Methods

The California Department of Pesticide Regulation (DPR) conducted a separate pesticide monitoring study of winter storm runoff in the Sacramento Valley during the same period as this study. DPR collected six water samples from two common sites (the Feather River at Verona and the Sacramento River at the Tower Bridge in Sacramento) on the same dates and at approximately the same times as the sampling efforts being conducted for this study. All samples were analyzed at the CDFA lab using the GCMS method described in this report.

The simultaneous collection and similar analysis allows a limited comparison of the detected concentrations of diazinon from two methods of sample collection: a grab sample taken (by DPR personnel) with a pole sampler from the riverbank and a velocity weighted composite sample taken (by UCD personnel) with a D-77 depth-integrating sampler, from a boat, at equal width increments (EWI) across the channel width. The first method is simple, less expensive and can be performed by one person. The second method is labor intensive and requires a boat and a three person sampling crew.

Three of the four samples collected with the EWI method from the Sacramento River at the Tower Bridge had concentrations (0.007 – 0.008 ppb) of diazinon at or just above the limit of detection (0.007 ppb). The fourth EWI sample showed no detection of diazinon. The four corresponding grab samples all had detections of diazinon ranging from 0.007 to 0.012 ppb. The EWI samples collected from the Feather River on 21 and 22 February had detections of 0.019 and 0.015 ppb, respectively. The corresponding grab samples had detections of 0.022 ppb and 0.016 ppb, respectively. Only the grab sample from the Feather River on 21 February had a detection of diazinon above the laboratory's reporting limit of 0.020 ppb.

Table 5. Comparison of diazinon concentrations using two different collection methods at two sites in the Sacramento River Basin, California.

E, estimate; µg/L, microgram per liter; <, less than; EWI, Equal Width Increments. Analysis by Gas Chromatography/Mass Spectrometry (GC/MS)

Site number	Site name	Site identification number	Date and time (month/day/year 24-hour time) ¹	Diazinon concentration (µg/L) of samples collected with EWI method ²	Diazinon concentration (µg/L) of samples collected with single grab from bank ²
3	Feather River at Verona	384752121375301	2/21/05 11:00, 11:10 2/22/05 11:10, 11:15	E 0.019 E 0.015	0.022 E 0.016
7	Sacramento River at the Tower Bridge	383430121302001	2/17/05 10:10, 10:15 2/18/05 9:50, 09:55 2/19/05 9:50, 10:00 2/21/05 10:00, 09:30	E 0.007 <0.007 E 0.008 E 0.008	E 0.008 E 0.012 E 0.007 E 0.008

¹ First sampling time is for EWI sample. Second sampling time is for grab sample

² Personnel from UC Davis collected composite samples using the EWI method, and a D77 sampler, from a boat. Personnel from California Department of Pesticide Regulation collected grab samples from the riverbank, at a single point, using a pole sampler.

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Appendices

Appendix 1a. Summary of environmental data collected on diazinon and chlorpyrifos concentrations and daily loading rates for sites in the Sacramento River Basin, California.

Stream flow is in cubic feet per second. IG, integrated grab; BG, bank grab; J, estimate; NA, not available; grams a.i./d, grams active ingredient per day; µg/L, microgram per liter; <, less than; BL, biased low due to low surrogate recovery in sample; BLB, biased low due to low surrogate recovery in associated lab blank or lab spike (see Appendices 5 & 6 for details).

Site number	Site name	Site identification number	Date and time (month/day/year 24-hour time)	Collection method	Stream flow (cfs)	Chlorpyrifos concentration (µg/L)	Chlorpyrifos daily loading rate (grams a.i./d)	Diazinon concentration (µg/L)	Diazinon daily loading rate (grams a.i./d)
1	Colusa Basin Drain near Knight's Landing	11390890	2/15/05 15:40	IG	955	<0.004	NA	J 0.010	23.36
			2/16/05 11:30	IG	1019	<0.004	NA	J 0.013	32.41
			2/17/05 14:00	IG	1140	<0.004	NA	J 0.010	27.89
			2/18/05 14:40	IG	1189	<0.004	NA	J 0.017	49.45
			2/19/05 13:10	IG	1444	<0.004	NA	J 0.017	60.06
			2/20/05 15:10	IG	2078	<0.004	NA	0.034	172.85
			2/21/05 14:00	IG	NA	<0.004	NA	J 0.018	NA
			2/22/05 15:30	IG	2845	<0.004	NA	0.026	180.97
			2/23/05 14:20	IG	2996	<0.004	NA	0.020	146.59
			2/24/05 14:20	IG	3038	<0.004	NA	0.021	156.08
			2/25/05 14:10	IG	2982	<0.004	NA	0.022	160.50
2	Sacramento River at Colusa	11389500	2/15/05 18:30 ¹	IG	11700	<0.004	NA	<0.007	NA
			2/16/05 15:20	IG	10900	<0.004	NA	<0.007	NA
			2/17/05 12:20	IG	10200	<0.004	NA	<0.007	NA
			2/18/05 11:40	IG	10300	<0.004	NA	<0.007	NA
			2/19/05 13:20	IG	10200	<0.004	NA	<0.007	NA
			2/20/05 12:30	IG	11600	<0.004	NA	<0.007	NA
			2/21/05 12:20	IG	17600	<0.004	NA	<0.007	NA
			2/22/05 14:30	IG	16500	<0.004	NA	<0.007	NA
			2/23/05 12:10	IG	15800	<0.004	NA	<0.007	NA
			2/24/05 12:30	IG	17600	<0.004	NA	<0.007	NA
			2/25/05 12:00	IG	17400	<0.004	NA	<0.007	NA

¹ This sample had low surrogate recovery (75%) during analysis. Due to a back up of samples waiting to be analyzed the low recovery was not noticed until over a month past the holding period. Therefore the sample was not re-extracted and re-analyzed. The results of the analysis should be viewed as biased low.

Appendix 1a. Summary of environmental data collected on diazinon and chlorpyrifos concentrations and daily loading rates for sites in the Sacramento River Basin, California – *Continued*

Site number	Site name	Site identification number	Date and time (month/day/year 24-hour time)	Collection method	Stream flow (cfs)	Chlorpyrifos concentration (µg/L)	Chlorpyrifos daily loading rate (grams a.i./d)	Diazinon concentration (µg/L)	Diazinon daily loading rate (grams a.i./d)
3	Feather River at Verona	384752121375301	2/16/05 12:00	IG	4096	<0.004	NA	J 0.015	150.31
			2/17/05 11:40	IG	3964	<0.004	NA	BLB, J 0.015	145.47
			2/18/05 11:20	IG	4062	<0.004	NA	J 0.011	109.31
			2/19/05 12:30	IG	3463	<0.004	NA	J 0.014	118.61
			2/20/05 12:00	IG	4890	<0.004	NA	J 0.010	119.63
			2/21/05 11:00	IG	5017	<0.004	NA	J 0.019	233.21
			2/22/05 11:10	IG	6167	<0.004	NA	J 0.015	226.31
			2/23/05 11:10	IG	6062	<0.004	NA	<0.007	NA
			2/24/05 10:50	IG	5240	<0.004	NA	<0.007	NA
			2/25/05 10:40	IG	4697	<0.004	NA	<0.007	NA
4	Sacramento Slough	384649121381101	2/16/05 13:20	IG	771	<0.004	NA	0.041	77.34
			2/17/05 13:30	IG	1003	<0.004	NA	BLB 0.021	51.53
			2/18/05 12:50	IG	1126	<0.004	NA	0.039	107.44
			2/19/05 14:10	IG	987	<0.004	NA	0.031	74.86
			2/20/05 13:20	IG	926	<0.004	NA	0.032	72.49
			2/21/05 12:30	IG	951	<0.004	NA	0.034	79.11
			2/22/05 12:20	IG	1033	<0.004	NA	0.027	68.24
			2/23/05 12:30	IG	1697	<0.004	NA	0.029	120.40
			2/24/05 12:10	IG	1862	J 0.004	18.22	0.025	113.88
			2/25/05 12:40	IG	1818	<0.004	NA	0.017	75.61
5	Sacramento River at Veterans Br.	384027121373401	2/16/05 14:20	IG	16200	<0.004	NA	J 0.007	277.43
			2/17/05 14:50	IG	16800	<0.004	NA	BLB, J 0.007	287.71
			2/18/05 14:10	IG	16500	<0.004	NA	J 0.007	282.57
			2/19/05 15:40	IG	16400	<0.004	NA	J 0.009	361.10
			2/20/05 14:50	IG	17100	<0.004	NA	J 0.008	334.68
			2/21/05 14:00	IG	20800	<0.004	NA	J 0.011	559.76
			2/22/05 15:10	IG	26600	<0.004	NA	<0.007	NA
			2/23/05 13:40	IG	27300	<0.004	NA	J 0.007	467.53
			2/24/05 14:10	IG	26200	<0.004	NA	<0.007	NA
			2/25/05 14:00	IG	25900	<0.004	NA	<0.007	NA

Appendix 1a. Summary of environmental data collected on diazinon and chlorpyrifos concentrations and daily loading rates for sites in the Sacramento River Basin, California – *Continued*

Site number	Site name	Site identification number	Date and time (month/day/year 24-hour time)	Collection method	Stream flow (cfs) ²	Chlorpyrifos concentration (µg/L)	Chlorpyrifos daily loading rate (grams a.i./d)	Diazinon concentration (µg/L)	Diazinon daily loading rate (grams a.i./d)
6	Sacramento River at Tower Bridge	383430121302001	2/15/05 13:50	IG	20530	<0.004	NA	J 0.007	351.59
			2/16/05 10:20	IG	16895	<0.004	NA	J 0.008	330.67
			2/17/05 10:10	IG	19798	<0.004	NA	J 0.007	339.05
			2/18/05 9:50	IG	20940	<0.004	NA	<0.007	NA
			2/19/05 9:50	IG	21350	<0.004	NA	J 0.008	417.86
			2/20/05 10:00	IG	22432	<0.004	NA	J 0.008	439.04
			2/21/05 10:00	IG	27455	<0.004	NA	J 0.008	537.35
			2/22/05 11:30	IG	32004	<0.004	NA	<0.007	NA
			2/23/05 10:10	IG	33330	<0.004	NA	<0.007	NA
			2/24/05 10:50	IG	30430	<0.004	NA	J 0.008	595.58
			2/25/05 9:40	IG	30184	<0.004	NA	<0.007	NA
			2/26/05 14:20	IG	30330	<0.004	NA	<0.007	NA

² Flows in gray shade were generated by building a relationship between the I Street gage near the Tower Bridge and the Freeport gage approximately 15 miles downstream. This was done because the I Street gage was below its rating table at the time the sample was collected. The relationship is $Y=0.8321x + 5264.3$ with an r^2 value of 0.96.

Appendix 1b. Summary of environmental data collected on diazinon and chlorpyrifos concentrations and daily loading rates for sites in the Sacramento/San Joaquin Delta, California.

Stream flow is in cubic feet per second. IG, integrated grab; BG, bank grab; J, estimate; NA, not available; grams a.i./d, grams active ingredient per day; µg/L, microgram per liter; <, less than; B, biased low due to low surrogate recovery in sample; BLB, biased low due to low surrogate recovery in associated lab blank or lab spike (see Appendices 5 & 6 for details).

Site number	Site name	Site identification number	Date and time (month/day/year 24-hour time)	Collection method	Stream flow (cfs)	Chlorpyrifos concentration (µg/L)	Chlorpyrifos daily loading rate (grams a.i./d)	Diazinon concentration (µg/L)	Diazinon daily loading rate (grams a.i./d)
1	Mosher Slough at Mariners Drive	Delta 02	2/15/05 12:30	BG	NA	0.011	NA	0.012	NA
			2/16/05 13:10	BG	NA	0.012	NA	0.012	NA
			2/17/05 16:40	BG	NA	BLB, J 0.008	NA	BLB 0.011	NA
			2/18/05 15:10	BG	NA	0.036	NA	0.086	NA
			2/19/05 15:40	BG	NA	0.016	NA	0.089	NA
2	Five Mile Slough at Plymouth Road	Delta 03	2/15/05 12:50	BG	NA	<0.004	NA	0.130	NA
			2/16/05 13:30	BG	NA	0.018	NA	0.110	NA
			2/17/05 16:30	BG	NA	BLB 0.012	NA	BLB 0.110	NA
			2/18/05 14:50	BG	NA	0.028	NA	0.110	NA
			2/19/05 15:30	BG	NA	<0.004	NA	0.0970	NA
3	Calaveras River at Ijams Road	Delta 04	2/15/05 13:20	BG	23.23	<0.004	NA	0.096	5.46
			2/16/05 14:00	BG	146.21	J 0.009	3.22	0.032	11.45
			2/17/05 14:00	BG	332.59	BLB, J 0.005	4.07	<0.007	NA
			2/18/05 13:10	BG	140.28	J 0.006	2.06	J 0.008	2.75
			2/19/05 13:40	BG	262.96	J 0.006	3.86	J 0.007	4.50
4	Mid-Roberts Island Drain	Delta 05	2/15/05 15:20 ¹	BG	NA	<0.004	NA	<0.007	NA
			2/16/05 17:00	BG	NA	J 0.007	NA	0.030	NA
			2/17/05 12:50	BG	NA	<0.004	NA	BLB 0.023	NA
			2/18/05 12:10	BG	NA	J 0.005	NA	J 0.015	NA
			2/19/05 12:40	BG	NA	J 0.004	NA	J 0.011	NA

¹ This sample had a low surrogate recovery 64% during analysis. The sample should have been re-extracted and re-analyzed. The laboratory, through scheduling problems, failed to re-extract the sample in a timely manner. Since the sample was already 30 days past the holding period it was not re-extracted.

Appendix 1b. Summary of environmental data collected on diazinon and chlorpyrifos concentrations and daily loading rates for sites in the Sacramento River Basin, California – *Continued*

Site number	Site name	Site identification number	Date and time (month/day/year 24-hour time)	Collection method	Stream flow (cfs)	Chlorpyrifos concentration (µg/L)	Chlorpyrifos daily loading rate (grams a.i./d)	Diazinon concentration (µg/L)	Diazinon daily loading rate (grams a.i./d)
5	French Camp Slough at Airport Way	Delta 06	2/15/05 14:50	BG	40.90	<0.004	NA	0.030	3.00
			2/16/05 16:30	BG	706.00	J 0.007	12.09	0.047	81.18
			2/17/05 16:00	BG	1420.00	BLB, J 0.007	24.32	BLB, J 0.019	66.01
			2/18/05 12:40	BG	1779.00	J 0.004	17.41	J 0.018	78.34
			2/19/05 13:10	BG	854.00	J 0.007	14.63	0.021	43.88
6	Ulatis Creek at Brown Road	Delta 10	2/15/05 16:40	BG	168.26	<0.004	NA	<0.007	NA
			2/16/05 9:50	BG	1376.58	0.012	40.41	0.460	1549.19
			2/17/05 9:40	BG	316.70	BLB 0.034	26.34	BLB 0.180	139.47
			2/18/05 8:50	BG	249.54	0.032	19.54	0.070	42.73
			2/19/05 9:10	BG	354.76	0.027	23.43	0.085	73.77
7	Duck Slough	Delta 11	2/15/05 11:30 ²	BG	NA	<0.004	NA	<0.007	NA
			2/16/05 12:00	BG	NA	<0.004	NA	<0.007	NA
			2/17/05 11:50	BG	NA	<0.004	NA	BLB, J 0.008	NA
			2/18/05 11:00	BG	NA	J 0.005	NA	J 0.008	NA
			2/19/05 11:10	BG	NA	<0.004	NA	<0.007	NA

² This sample was re-analyzed due to low surrogate recovery (71%). The re-analysis recovery rate (83%) was within the acceptance limits specified in the QAPP.

Appendix 1c. Summary of environmental data collected on diazinon and chlorpyrifos concentrations and daily loading rates for sites in the San Joaquin River Basin, California.

Stream flow is in cubic feet per second. IG, integrated grab; BG, bank grab; J, estimate; NA, not available; grams a.i./d, grams active ingredient per day; µg/L, microgram per liter; <, less than; B, biased low due to low surrogate recovery in sample; BLB, biased low due to low surrogate recovery in associated lab blank or lab spike (see Appendices 5 & 6 for details).

Site number	Site name	Site identification number	Date and time (month/day/year 24-hour time)	Collection method	Stream flow (cfs)	Chlorpyrifos concentration (µg/L)	Chlorpyrifos daily loading rate (grams a.i./d)	Diazinon concentration (µg/L)	Diazinon daily loading rate (grams a.i./d)
1	Stanislaus River at Caswell State Park	374209121103800	1/27/2005 7:00	BG	296	0.022	15.93	0.190	137.59
			1/27/2005 11:50	BG	304	0.015	11.16	0.220	163.62
			1/28/2005 6:50	BG	464	0.015	17.03	0.300	340.55
			1/28/2005 11:20	BG	420	0.018	18.50	0.130	133.58
			1/29/2005 8:30	BG	825	0.018	36.33	0.170	343.12
			1/29/2005 13:00	BG	900	0.015	33.03	0.082	180.55
			1/30/2005 10:40	BG	566	0.009	12.46	0.088	121.86
			1/30/2005 15:30	BG	507	J 0.007	8.68	0.098	121.56
			2/15/2005 6:40 ³	BG	287	<0.004	NA	J 0.011	7.72
			2/15/2005 11:30 ⁴	BG	300	<0.004	NA	J 0.011	8.07
			2/16/2005 7:40	BG	346	J 0.005	4.23	0.038	32.17
			2/16/2005 12:10	BG	382	J 0.008	7.48	0.030	28.04
			2/17/2005 6:30	BG	669	J 0.005	8.18	0.052	85.11
			2/17/2005 11:00	BG	642	J 0.006	9.42	0.084	131.93
			2/18/2005 6:50	BG	511	<0.004	NA	BLB, J 0.019	23.75
			2/18/2005 11:20	BG	445	BLB, J 0.006	6.53	BLB 0.032	34.84
2	San Joaquin River at Vernalis	11303500	1/27/2005 7:40	IG	2850	J 0.007	48.81	0.050	348.63
			1/27/2005 12:20	IG	2850	0.010	69.73	0.077	536.88
			1/28/2005 7:20	IG	2940	J 0.007	50.35	0.054	388.41
			1/28/2005 11:50	IG	3240	0.010	79.27	0.040	317.07
			1/29/2005 9:00	IG	3810	J 0.009	83.89	0.047	438.09
			1/29/2005 13:30	IG	4020	J 0.009	88.51	0.056	550.76
			1/30/2005 11:10	IG	5720	0.013	181.92	0.047	657.72
			1/30/2005 16:10	IG	5640	0.011	151.78	0.045	620.92

³ This sample had a surrogate recovery of 50%. The sample should have been re-extracted and re-analyzed. The laboratory through scheduling problems failed to re-extract the sample in a timely manner. The scheduling of sample re-extractions was changed to facilitate timely re-extractions. Since the sample was over 30 days past the holding time the sample was not re-extracted.

⁴ This sample had a slightly low surrogate recovery of 77%. The sample was re-analyzed on 23 March. The surrogate recovery was 90% meeting the QAPP acceptance limits.

Appendix 1c. Summary of environmental data collected on diazinon and chlorpyrifos concentrations and daily loading rates for sites in the San Joaquin River Basin, California.
(continued)

Site number	Site name	Site identification number	Date and time (month/day/year 24-hour time)	Collection method	Stream flow (cfs)	Chlorpyrifos concentration (µg/L)	Chlorpyrifos daily loading rate (grams a.i./d)	Diazinon concentration (µg/L)	Diazinon daily loading rate (grams a.i./d)
2	San Joaquin River at Vernalis <i>cont.</i>	11303500	2/15/2005 7:20	IG	3390	<0.004	NA	<0.007	NA
			2/15/2005 12:10	IG	3420	<0.004	NA	<0.007	NA
			2/16/2005 8:20	IG	3890	J 0.005	47.58	J 0.013	123.72
			2/16/2005 12:50	IG	4120	<0.004	NA	J 0.012	120.95
			2/17/2005 7:10	IG	5040	<0.004	NA	J 0.014	172.63
			2/17/2005 11:30	IG	5300	<0.004	NA	J 0.011	142.63
			2/18/2005 7:30	IG	5900	<0.004	NA	BLB, J 0.007	101.04
			2/18/2005 11:50	IG	5940	BLB, J 0.004	58.13	<0.007	NA
3	Tuolumne River at Shiloh Road	11290200	1/27/2005 8:20	IG	285	0.025	17.43	0.570	397.43
			1/27/2005 13:00	IG	294	0.024	17.26	0.490	352.44
			1/28/2005 8:00	IG	1100	0.013	34.98	0.040	107.65
			1/28/2005 12:40	IG	867	0.013	27.57	0.040	84.84
			1/29/2005 9:20	IG	2410	0.013	76.65	0.130	766.49
			1/29/2005 14:00	IG	2960	0.012	86.90	0.044	318.63
			1/30/2005 11:50	IG	1170	J 0.008	22.90	0.099	283.38
			1/30/2005 16:30	IG	938	0.010	22.95	0.16	367.17
			2/15/2005 8:00 ⁵	IG	1780	<0.004	NA	J 0.014	60.97
			2/15/2005 12:50	IG	1900	<0.004	NA	<0.007	NA
			2/16/2005 9:00	IG	2100	J 0.007	35.96	J 0.018	92.48
			2/16/2005 13:20	IG	2120	J 0.005	25.93	J 0.013	67.43
			2/17/2005 7:40 ⁶	IG	3060	J 0.005	37.43	J 0.010	74.86
			2/17/2005 12:10	IG	3130	J 0.005	38.29	<0.007	NA
			2/18/2005 8:00	IG	2930	<0.004	NA	<0.007	NA
			2/18/2005 12:20	IG	2900	BLB, J 0.005	35.47	<0.007	NA

⁵ This sample had a slightly low surrogate recovery of 76%. The sample was re-analyzed on 23 March. The surrogate recovery was 94% meeting the QAPP acceptance limits.

⁶ This sample had a Simazine value above the highest standard used by the CDFA lab. The dilution was overlooked and the sample extract dried out. The value reported for Simazine is an estimated concentration.

Appendix 1c. Summary of environmental data collected on diazinon and chlorpyrifos concentrations and daily loading rates for sites in the San Joaquin River Basin, California.
(continued)

Site number	Site name	Site identification number	Date and time (month/day/year 24-hour time)	Collection method	Stream flow (cfs)	Chlorpyrifos concentration (µg/L)	Chlorpyrifos daily loading rate (grams a.i./d)	Diazinon concentration (µg/L)	Diazinon daily loading rate (grams a.i./d)
4	Merced River at River Road	11273500	1/27/2005 9:20 ⁷	IG	309	J 0.008	6.05	J 0.014	10.58
			1/28/2005 8:50	IG	738	0.040	72.22	0.120	216.66
			1/29/2005 10:30	IG	915	0.027	60.44	0.043	96.26
			1/30/2005 13:00	IG	771	0.054	101.86	0.095	179.19
			2/15/2005 9:20	IG	276	<0.004	NA	<0.007	NA
			2/16/2005 10:20	IG	299	<0.004	NA	<0.007	NA
			2/17/2005 8:50	IG	738	<0.004	NA	<0.007	NA
			2/18/2005 9:20	IG	564	BLB 0.012	16.56	BLB, J 0.019	26.22
5	San Joaquin River at Lander Avenue	11260815	1/27/2005 9:50	BG	795	J 0.007	13.61	J 0.013	25.28
			1/28/2005 9:20	BG	1418	0.010	34.69	0.032	111.01
			1/29/2005 11:00	BG	1575	0.010	38.53	0.032	123.30
			1/30/2005 13:20	BG	1783	J 0.008	34.90	0.018	78.52
6	San Joaquin River at Patterson	11274570	2/15/2005 8:40	BG	981	<0.004	NA	J 0.008	19.20
			2/16/2005 9:40	BG	1443	<0.004	NA	J 0.011	38.83
			2/17/2005 8:10	BG	1830	0.010	44.77	<0.007	NA
			2/18/2005 8:40	BG	2195	<0.004	NA	BLB, J 0.011	59.07

⁷ This sample had a slightly low surrogate recovery of 74%. The sample was re-analyzed on 23 March. The surrogate recovery was 93% meeting the QAPP acceptance limits.

Appendix 2. Summary of diazinon concentrations for sites in the Sacramento River Basin, California analyzed by Gas Chromatography/Mass Spectrometry (GC/MS) and by Enzyme-Linked Immunosorbent Assay (ELISA).

J, estimate; NA, not available; µg/L, microgram per liter; <, less than; BLB, biased low due to low surrogate recovery in associated lab blank or lab spike (see Appendices 5 & 6 for details).

Site number	Site name	Site identification number	Date and time (month/day/year 24-hour time)	Diazinon concentration (µg/L, GC/MS)	Diazinon concentration (µg/L, ELISA)
1	Colusa Basin Drain near Knight's Landing	11390890	2/15/05 15:40	J 0.010	0.014
			2/16/05 11:30	J 0.013	0.017
			2/17/05 14:00	J 0.010	0.017
			2/18/05 14:40	J 0.017	0.017
			2/19/05 13:10	J 0.017	0.017
			2/20/05 15:10	0.034	0.040
			2/21/05 14:00	J 0.018	0.028
			2/22/05 15:30	0.026	0.031
			2/23/05 14:20	J 0.020	0.030
			2/24/05 14:20	0.021	0.034
			2/25/05 14:10	0.022	NA
2	Sacramento River at Colusa	11389500	2/15/05 18:30	<0.007 ⁸	0.012
			2/16/05 15:20	<0.007	0.012
			2/17/05 12:20	<0.007	0.015
			2/18/05 13:20	<0.007	0.017
			2/19/05 11:40	<0.007	0.008
			2/20/05 12:30	<0.007	0.014
			2/21/05 12:20	<0.007	0.023
			2/22/05 14:30	<0.007	0.017
			2/23/05 12:10	<0.007	0.021
			2/24/05 12:30	<0.007	0.021
			2/25/05 12:00	<0.007	NA
3	Feather River at Verona	384752121375301	2/16/05 12:00	J 0.015	0.018
			2/17/05 11:40	BLB, J 0.015	0.024
			2/18/05 11:20	J 0.011	0.023
			2/19/05 12:30	J 0.014	0.012
			2/20/05 12:00	J 0.010	0.022
			2/21/05 11:00	J 0.019	0.029
			2/22/05 11:10	J 0.015	0.027
			2/23/05 11:10	<0.007	0.023
			2/24/05 10:50	<0.007	0.025
			2/25/05 10:40	<0.007	NA
5	Sacramento Slough	384649121381101	2/16/05 13:20	0.041	0.031
			2/17/05 13:30	BLB 0.021	0.039
			2/18/05 12:50	0.039	0.032
			2/19/05 14:10	0.031	0.020
			2/20/05 13:20	0.032	0.041
			2/21/05 12:30	0.034	0.039
			2/22/05 12:20	0.027	0.032
			2/23/05 12:30	0.029	0.037
			2/24/05 12:10	0.025	0.029
			2/25/05 12:40	J 0.017	NA

⁸ This sample had low surrogate recovery (75%) during analysis. Due to a back up of samples waiting to be analyzed the low recovery was not noticed until over a month past the holding period. Therefore the sample was not re-extracted and re-analyzed. The results of the analysis should be viewed as biased low.

Appendix 2. Summary of diazinon concentrations for sites in the Sacramento River Basin, California analyzed by Gas Chromatography/Mass Spectrometry (GC/MS) and by Enzyme-Linked Immunosorbent Assay (ELISA) -

Continued

Site number	Site name	Site identification number	Date and time (month/day/year 24-hour time)	Diazinon concentration (µg/L), GC/MS	Diazinon concentration (µg/L), ELISA
6	Sacramento River at Veterans Br.	384027121373401	2/16/05 14:20	J 0.007	0.018
			2/17/05 14:50	BLB, J 0.007	0.014
			2/18/05 14:10	J 0.007	0.010
			2/19/05 15:40	J 0.009	0.011
			2/20/05 14:50	J 0.008	0.021
			2/21/05 14:00	J 0.011	0.021
			2/22/05 15:10	<0.007	0.019
			2/23/05 13:40	J 0.007	0.021
			2/24/05 14:10	<0.007	0.023
			2/25/05 14:00	<0.007	NA
7	Sacramento River at Tower Bridge	383430121302001	2/15/05 13:50	J 0.007	0.016
			2/16/05 10:20	J 0.008	0.018
			2/17/05 10:10	J 0.007	0.016
			2/18/05 9:50	<0.007	0.011
			2/19/05 9:50	J 0.008	0.012
			2/20/05 10:00	J 0.008	0.021
			2/21/05 10:00	J 0.008	0.015
			2/22/05 11:30	<0.007	0.024
			2/23/05 10:10	<0.007	0.024
			2/24/05 10:50	J 0.008	0.022
			2/25/05 9:40	<0.007	NA
			2/26/05 14:20	<0.007	NA

Appendix 3a. Summary of diazinon and chlorpyrifos concentrations quality-control data for sites in the Sacramento River Basin, California.

NA: not applicable - cannot be calculated because of "less than" concentration; µg/L: microgram per liter; J: estimate; <: less than; BLB: biased low due to low surrogate recovery in associated lab blank or lab spike (see Appendices 5 & 6 for details).

Site identification number	Site name	Date and time (month/day/year 24-hour time)	Chlorpyrifos (ug/L)	Relative percent difference OR percent recovery (chlorpyrifos)*	Diazinon (ug/L)	Relative percent difference OR percent recovery (diazinon)*
<u>DUPLICATES</u>						
384649121381101	Sacramento Slough	2/17/05 13:30 2/17/05 13:33 ¹	<0.004 <0.004	NA	BLB 0.021 0.025	17.39%
383430121302001	Sacramento River at Tower Bridge	2/16/05 10:20 2/16/05 10:23 ²	<0.004 <0.004	NA	J 0.008 J 0.009	11.76%
384752121375301	Feather River near Verona	2/20/05 12:00 2/20/05 12:03 ²	<0.004 <0.004	NA	J 0.010 J 0.011	9.52%
11389500	Sacramento River at Colusa	2/23/05 12:10 2/23/05 12:16 ^{1,3}	<0.004 <0.004	NA	<0.007 <0.007	NA
<u>BLANKS</u>						
11390890	Colusa Basin Drain near Knights Landing	2/15/05 15:41 ⁴	<0.004		<0.007	
383430121302001	Sacramento River at Tower Bridge	2/15/05 13:51 ^{4,7}	<0.004		<0.007	
384027121373401	Sacramento River at Veterans Bridge	2/16/05 10:00 ^{3,4}	<0.004		<0.007	
11390890	Colusa Basin Drain near Knights Landing	2/17/05 14:01	<0.004		<0.007	
384752121375301	Feather River near Verona	2/25/05 10:41	<0.004		<0.007	
383430121302001	Sacramento River at Tower Bridge	2/24/05 10:51	<0.004		<0.007	
384649121381101	Sacramento Slough	2/21/05 12:31	<0.004		<0.007	
<u>SPIKES, SPIKE DUPLICATES^{5,6}</u>						
11389500	Sacramento River at Colusa	2/15/05 18:30 2/15/05 18:39 2/15/05 18:39	<0.004	94% 94% 0%	<0.007	107% 107% 0%
11389500	Sacramento River at Colusa	2/25/05 12:00 2/25/05 12:09 2/25/05 12:09	<0.004	90% 88% 2%	<0.007	93% 103% 10%
384027121373401	Sacramento River at Veterans Bridge	2/19/05 15:40 2/19/05 15:49 2/19/05 15:49	<0.004	89% 80% 11%	J 0.009	106% 82% 26%
384752121375301	Feather River near Verona	2/19/05 12:30 2/19/05 12:39 2/19/05 12:39	<0.004	82% 97% 17%	J 0.014	88% 104% 17%

¹ Sequential Duplicate

² Split Duplicate

³ Sample time offset incorrect

⁴ Equipment Blank

⁵ Spiked samples were injected with 0.05 ug/L of chlorpyrifos; 0.10 ug/L of diazinon

⁶ First line is environmental sample, second is matrix spike, third is matrix spike duplicate

⁷ Sample was re-analyzed due to a low surrogate recovery (75%). The re-analysis recovery rate (92%) was within the QAPP acceptance limits.

*Relative percent difference between matrix spike (MS) and matrix spike duplicate (MSD) is listed in bold italics below MS & MSD recoveries

Appendix 3b. Summary of diazinon and chlorpyrifos concentrations quality-control data for sites in the Sacramento/San Joaquin Delta, California.

NA: not applicable - cannot be calculated because of "less than" concentration; µg/L: microgram per liter; J: estimate; <: less than; BLB: biased low due to low surrogate recovery in associated lab blank or lab spike (see Appendices 5 & 6 for details); R: data rejected.

Site identification number	Site name	Date and time (month/day/year 24-hour time)	Chlorpyrifos (ug/L)	Relative percent difference OR percent recovery (chlorpyrifos)*	Diazinon (ug/L)	Relative percent difference OR percent recovery (diazinon)*
DUPLICATES						
Delta 02	Mosher Slough at Mariners Drive	2/15/05 12:30 2/15/05 12:35 ¹	0.011 0.011	0.00%	0.120 0.130	8%
Delta 11	Duck Slough	2/16/05 12:00 2/16/05 12:05 ¹	<0.004 <0.004	NA	<0.007 <0.007	NA
Delta 04	Calaveras River at Ijams Road	2/17/05 14:00 2/17/05 14:00 ² 2/17/05 14:00 ²	BLB, J 0.005 BLB, J 0.006 BLB, J 0.008	18.18% 46.15%	<0.007 <0.007 <0.007	NA NA
Delta 05	Mid-Roberts Island Drain	2/18/05 12:10 ¹ 2/18/05 12:15	J 0.005 J 0.005	0.00%	J 0.015 J 0.012	22.22%
BLANKS						
	Equipment Blank	2/15/05 18:30 ³	<0.004(R)		<0.007(R)	
Delta 03	Five Mile Slough at Plymouth Road	2/16/05 13:35	<0.004		<0.007	
Delta 06	French Camp Slough at Airport Way	2/19/05 13:15 ⁴	<0.004		<0.007	
SPIKES ^{5,6}						
Delta 10	Ulatis Creek at Brown Road	2/15/05 16:40 2/15/05 16:40 2/15/05 16:40	<0.004	81% 82% 1%	<0.007	83% 87% 5%

¹Split Duplicate

²These samples should have been analyzed as matrix spikes. The lab failed to add the matrix spike standard prior to extraction. They can be viewed as duplicates

³Surrogate recovery (66%) was outside of QAPP acceptance limits of 80-125%. Sample not re-analyzed due to lab scheduling error.

⁴Surrogate recovery (74%) was outside of QAPP acceptance limits of 80-125%. The sample was diluted by mistake and reanalyzed. The undiluted sample was reanalyzed on 4/6/2005. This reanalysis also had low surrogate recovery (62%). The sample was not re-extracted due to laboratory error. This error was not noted until over 4 weeks past the time of sample collection.

⁵Spiked samples were injected with 0.05 ug/L of chlorpyrifos; 0.10 ug/L of diazinon

⁶First sample in each pair is the environmental sample, second is matrix spike, third is matrix spike duplicate

*Relative percent difference between matrix spike (MS) and matrix spike duplicate (MSD) is listed in bold italics below MS & MSD recoveries

Appendix 3c. Summary of diazinon and chlorpyrifos concentrations quality-control data for sites in the San Joaquin River Basin, California.

NA: not applicable - cannot be calculated because of "less than" concentration; µg/L: microgram per liter; J: estimate; <: less than; BLB: biased low due to low surrogate recovery in associated lab blank or lab spike (see Appendices 5 & 6 for details).

Site identification number	Site name	Date and time (month/day/year 24-hour time)	Chlorpyrifos (ug/L)	Relative percent difference OR percent recovery (chlorpyrifos)*	Diazinon (ug/L)	Relative percent difference OR percent recovery (diazinon)*
<u>DUPLICATES</u>						
374209121103800	Stanislaus River at Caswell State Park	1/28/2005 11:20 1/28/2005 11:23 ¹	0.018 0.017	5.71%	0.130 0.140	7.41%
1126110	San Joaquin River at Lander Avenue	1/27/2005 9:50 1/27/2005 9:53 ¹	J 0.007 J 0.007	0.00%	J 0.013 J 0.012	8.00%
11303500	San Joaquin River at Vernalis	2/15/2005 12:10 2/15/2005 12:13 ¹	<0.004 <0.004	NA	<0.007 <0.007	NA
11273500	Merced River at River Road	2/18/2005 9:20 2/18/2005 9:23 ¹	BLB 0.012 BLB 0.012	0.00%	BLB, J 0.019 BLB 0.020	5.13%
<u>BLANKS</u>						
11290200	Tuolumne River at Shiloh Road	1/29/2005 9:21	<0.004		<0.007	
374209121103800	Stanislaus River at Caswell State Park	2/16/2005 7:41	<0.004		<0.007	
<u>SPIKES, SPIKE DUPLICATES^{2,3}</u>						
11303500	San Joaquin River at Vernalis	1/27/2005 7:40 1/27/2005 7:49	J 0.007	94%	0.050	121%
11273500	Merced River at River Road	1/30/2005 13:00 1/30/2005 13:09	0.054	84%	0.095	88%
11290200	Tuolumne River at Shiloh Road	2/17/2005 12:10 2/17/2005 12:19 2/17/2005 12:19	J 0.005	77% 89% 14%	<0.007	114% 118% 3%
11274570	San Joaquin River at Patterson	2/18/2005 8:40 2/18/2005 8:49 2/18/2005 8:49	<0.004	95% 98% 3%	BLB, J 0.011	95% 100% 5%
¹ Split Duplicate ² Spiked samples were injected with 0.05 ug/L of chlorpyrifos; 0.10 ug/L of diazinon ³ First sample in each pair is the environmental sample, second is matrix spike, third is matrix spike duplicate * Relative percent difference between matrix spike (MS) and matrix spike duplicate (MSD) is listed in bold italics below MS & MSD recoveries						

Appendix 4a. Sacramento pesticide results (excluding diazinon and chlorpyrifos).

(Concentrations are in units of µg/L. ND: Not detected; J: estimated value; B: biased low due to low surrogate recovery in sample; BLB: biased low due to low surrogate recovery in associated lab blank or lab spike (see Appendices 5 & 6 for details). Each sample was also analyzed for proparigate, bifenthrin and azinphos methyl which were not present at detectable levels).

Site	Date	Time	EPTC (Eptam)	Simazine	Carbaryl	Metolachlor	Cyan-azine	Dacthal (DCPA)	Methid-athion
Colusa Basin Drain at Knights Landing	15-Feb-05	15:40	ND	(0.032 J)	ND	(0.007 J)	ND	ND	ND
Colusa Basin Drain at Knights Landing	16-Feb-05	11:30	ND	(0.035 J)	ND	ND	ND	ND	ND
Colusa Basin Drain at Knights Landing	17-Feb-05	14:00	ND	0.31	ND	(0.017 J)	ND	ND	ND
Colusa Basin Drain at Knights Landing	18-Feb-05	14:40	ND	(0.076 J)	ND	0.028	ND	ND	ND
Colusa Basin Drain at Knights Landing	19-Feb-05	13:10	ND	(0.12 J)	ND	0.036	ND	ND	ND
Colusa Basin Drain at Knights Landing	20-Feb-05	15:10	ND	(0.20 J)	ND	0.053	ND	ND	ND
Colusa Basin Drain at Knights Landing	21-Feb-05	14:00	ND	0.28	ND	0.026	ND	ND	ND
Colusa Basin Drain at Knights Landing	22-Feb-05	15:30	ND	0.47	ND	0.031	ND	ND	ND
Colusa Basin Drain at Knights Landing	23-Feb-05	14:20	ND	0.32	ND	0.021	ND	ND	ND
Colusa Basin Drain at Knights Landing	24-Feb-05	14:20	ND	0.44	ND	(0.017 J)	ND	ND	ND
Colusa Basin Drain at Knights Landing	25-Feb-05	14:10	ND	0.27	ND	(0.017 J)	ND	ND	ND
Sacramento River at Colusa ¹	15-Feb-05	18:30	ND	BL (0.006 J)	ND	ND	ND	ND	ND
Sacramento River at Colusa	16-Feb-05	15:20	ND	(0.009 J)	ND	ND	ND	ND	ND
Sacramento River at Colusa	17-Feb-05	12:20	ND	ND	ND	ND	ND	ND	ND
Sacramento River at Colusa	18-Feb-05	13:20	ND	ND	ND	ND	ND	ND	ND
Sacramento River at Colusa	19-Feb-05	11:40	ND	(0.005 J)	ND	ND	ND	ND	ND
Sacramento River at Colusa	20-Feb-05	12:30	ND	(0.035 J)	ND	ND	ND	ND	ND
Sacramento River at Colusa	21-Feb-05	12:20	ND	(0.021 J)	ND	ND	ND	ND	ND
Sacramento River at Colusa	22-Feb-05	14:30	ND	(0.019 J)	ND	ND	ND	ND	ND
Sacramento River at Colusa	23-Feb-05	12:10	ND	(0.006 J)	ND	ND	ND	ND	ND
Sacramento River at Colusa	24-Feb-05	12:30	ND	(0.005 J)	ND	ND	ND	ND	ND
Sacramento River at Colusa	25-Feb-05	12:00	ND	(0.006 J)	ND	ND	ND	ND	ND
Feather River near Verona	16-Feb-05	12:00	ND	ND	ND	ND	ND	ND	ND
Feather River near Verona	17-Feb-05	11:40	ND	ND	ND	ND	ND	ND	ND
Feather River near Verona	18-Feb-05	11:20	ND	ND	ND	ND	ND	ND	ND
Feather River near Verona	19-Feb-05	12:30	ND	ND	ND	ND	ND	ND	ND

¹ This sample had low surrogate recovery (75%) during analysis. Due to a back up of samples waiting to be analyzed the low recovery was not noticed until over a month past the holding period. Therefore the sample was not re-extracted and re-analyzed. The results of the analysis should be viewed as biased low.

Appendix 4a (Continued)

Site	Date	Time	EPTC (Eptam)	Simazine	Carbaryl	Metolachlor	Cyan-azine	Dacthal (DCPA)	Methid-athion
Feather River near Verona	20-Feb-05	12:00	ND	ND	ND	ND	ND	ND	ND
Feather River near Verona	21-Feb-05	11:00	ND	ND	ND	ND	ND	ND	ND
Feather River near Verona	22-Feb-05	11:10	ND	(0.006 J)	ND	ND	ND	ND	ND
Feather River near Verona	23-Feb-05	11:10	ND	ND	ND	ND	ND	ND	ND
Feather River near Verona	24-Feb-05	10:50	ND	(0.011 J)	ND	ND	ND	ND	ND
Feather River near Verona	25-Feb-05	10:40	ND	(0.007 J)	ND	ND	ND	ND	ND
Sacramento Slough	16-Feb-05	13:20	ND	(0.014 J)	ND	ND	ND	ND	ND
Sacramento Slough	17-Feb-05	13:30	ND	BLB (0.008 J)	ND	ND	ND	ND	ND
Sacramento Slough	18-Feb-05	12:50	ND	(0.010 J)	ND	(0.010 J)	ND	ND	ND
Sacramento Slough	19-Feb-05	14:10	ND	(0.012 J)	ND	(0.007 J)	ND	ND	ND
Sacramento Slough	20-Feb-05	13:20	ND	(0.023 J)	ND	(0.013 J)	ND	ND	ND
Sacramento Slough	21-Feb-05	12:30	ND	(0.022 J)	ND	0.021	ND	ND	ND
Sacramento Slough	22-Feb-05	12:20	ND	(0.024 J)	ND	(0.010 J)	ND	ND	ND
Sacramento Slough	23-Feb-05	12:30	ND	(0.047 J)	ND	(0.010 J)	ND	ND	ND
Sacramento Slough	24-Feb-05	12:10	ND	(0.046 J)	ND	(0.012 J)	ND	ND	ND
Sacramento Slough	25-Feb-05	12:40	ND	(0.038 J)	ND	(0.017 J)	ND	ND	ND
Sacramento Slough	26-Feb-05	10:30	ND	(0.037 J)	ND	(0.013 J)	ND	ND	ND
Sacramento River at Veteran's Bridge	16-Feb-05	14:20	ND	(0.010 J)	ND	ND	ND	ND	ND
Sacramento River at Veteran's Bridge	17-Feb-05	14:50	ND	BLB (0.013 J)	ND	ND	ND	ND	ND
Sacramento River at Veteran's Bridge	18-Feb-05	14:10	ND	(0.022 J)	ND	ND	ND	ND	ND
Sacramento River at Veteran's Bridge	19-Feb-05	15:40	ND	(0.013 J)	ND	ND	ND	ND	ND
Sacramento River at Veteran's Bridge	20-Feb-05	14:50	ND	(0.021 J)	ND	ND	ND	ND	ND
Sacramento River at Veteran's Bridge	21-Feb-05	14:00	ND	(0.036 J)	ND	ND	ND	ND	ND
Sacramento River at Veteran's Bridge	22-Feb-05	15:10	ND	(0.021 J)	ND	ND	ND	ND	ND
Sacramento River at Veteran's Bridge	23-Feb-05	13:40	ND	(0.039 J)	ND	ND	ND	ND	ND
Sacramento River at Veteran's Bridge	24-Feb-05	14:10	ND	(0.037 J)	ND	ND	ND	ND	ND
Sacramento River at Veteran's Bridge	25-Feb-05	14:00	ND	(0.026 J)	ND	ND	ND	ND	ND
Sacramento River at Tower Bridge	15-Feb-05	13:50	ND	(0.009 J)	ND	ND	ND	ND	ND
Sacramento River at Tower Bridge	16-Feb-05	10:20	ND	(0.035 J)	ND	ND	ND	ND	ND
Sacramento River at Tower Bridge	17-Feb-05	10:10	ND	(0.043 J)	ND	ND	ND	ND	ND
Sacramento River at Tower Bridge	18-Feb-05	09:50	ND	(0.018 J)	ND	ND	ND	ND	ND
Sacramento River at Tower Bridge	19-Feb-05	09:50	ND	(0.040 J)	ND	ND	ND	ND	ND
Sacramento River at Tower Bridge	20-Feb-05	10:00	ND	(0.075 J)	ND	ND	ND	ND	ND

Appendix 4a (Continued)									
Site	Date	Time	EPTC (Eptam)	Simazine	Carbaryl	Metolachlor	Cyan-azine	Dacthal (DCPA)	Methid-athion
Sacramento River at Tower Bridge	21-Feb-05	10:00	ND	(0.053 J)	ND	ND	ND	ND	ND
Sacramento River at Tower Bridge	22-Feb-05	11:30	ND	(0.021 J)	ND	ND	ND	ND	ND
Sacramento River at Tower Bridge	23-Feb-05	10:10	ND	(0.038 J)	ND	ND	ND	ND	ND
Sacramento River at Tower Bridge	24-Feb-05	10:50	ND	(0.032 J)	ND	ND	ND	ND	ND
Sacramento River at Tower Bridge	25-Feb-05	09:40	ND	(0.035 J)	ND	ND	ND	ND	ND
Sacramento River at Tower Bridge	26-Feb-05	14:20	ND	0.020	ND	ND	ND	ND	ND

Appendix 4b. Delta pesticide results (excluding diazinon and chlorpyrifos).

(Concentrations are in units of µg/L. ND: Not detected; J: estimated value; B: biased low due to low surrogate recovery in sample; BLB: biased low due to low surrogate recovery in associated lab blank or lab spike (see Appendices 5 & 6 for details). Each sample was also analyzed for propargate, bifenthrin and azinphos methyl which were not present at detectable levels).

Site	Date	Time	EPTC (Eptam)	Simazine	Carbaryl	Metolachlor	Cyan-azine	Dacthal (DCPA)	Methid-athion
Calaveras River at Ijams Rd	15-Feb-05	13:20	ND	0.270	ND	(0.018 J)	ND	ND	ND
Calaveras River at Ijams Rd	16-Feb-05	14:00	ND	0.520	ND	ND	ND	ND	(0.017 J)
Calaveras River at Ijams Rd	17-Feb-05	14:00	ND	BLB 1.700	ND	ND	ND	ND	ND
Calaveras River at Ijams Rd	18-Feb-05	13:10	ND	1.300	ND	ND	ND	ND	ND
Calaveras River at Ijams Rd	19-Feb-05	13:40	ND	0.970	ND	ND	ND	ND	ND
Duck Slough ⁹	15-Feb-05	11:30	ND	0.290	ND	ND	ND	ND	ND
Duck Slough	16-Feb-05	12:00	ND	0.240	ND	ND	ND	ND	ND
Duck Slough	17-Feb-05	11:50	ND	BLB 0.240	ND	ND	BLB (0.016 J)	ND	ND
Duck Slough	18-Feb-05	11:00	ND	0.440	ND	ND	ND	ND	ND
Duck Slough	19-Feb-05	11:10	ND	(0.010 J)	ND	(0.017 J)	ND	ND	ND
Five-mile Slough at Plymouth Rd	15-Feb-05	12:50	ND	0.240	ND	(0.011 J)	ND	ND	ND
Five-mile Slough at Plymouth Rd	16-Feb-05	13:30	ND	(0.066 J)	ND	ND	ND	ND	ND
Five-mile Slough at Plymouth Rd	17-Feb-05	16:30	ND	BLB (0.11 J)	BLB 0.048	ND	ND	ND	ND
Five-mile Slough at Plymouth Rd	18-Feb-05	14:50	ND	(0.050 J)	0.038	ND	ND	ND	ND
Five-mile Slough at Plymouth Rd	19-Feb-05	15:30	ND	0.240	0.030	ND	ND	ND	ND
French Camp Slough at Airport Way	15-Feb-05	14:50	ND	0.530	ND	ND	ND	ND	ND
French Camp Slough at Airport Way	16-Feb-05	16:30	ND	1.700	ND	(0.015 J)	ND	ND	0.058
French Camp Slough at Airport Way	17-Feb-05	16:00	ND	BLB 0.700	ND	BLB (0.014 J)	ND	ND	ND
French Camp Slough at Airport Way	18-Feb-05	12:40	ND	0.570	ND	ND	ND	ND	ND
French Camp Slough at Airport Way	19-Feb-05	13:10	ND	0.860	ND	ND	ND	ND	ND
Mid Roberts Island Drain ¹⁰	15-Feb-05	15:20	ND	B 0.270	ND	B 0.054	ND	ND	ND
Mid Roberts Island Drain	16-Feb-05	17:00	ND	0.810	ND	0.250	ND	ND	ND
Mid Roberts Island Drain	17-Feb-05	12:50	ND	BLB 1.700	ND	BLB 0.330	ND	ND	ND
Mid Roberts Island Drain	18-Feb-05	12:10	ND	1.900	ND	0.470	ND	ND	ND

⁹ This sample was re-analyzed due to low surrogate recovery (71%). The re-analysis recovery rate (83%) was within the acceptance limits specified in the QAPP.

¹⁰ This sample had a low surrogate recovery 64% during analysis. The sample should have been re-extracted and re-analyzed. The laboratory, through scheduling problems, failed to re-extract the sample in a timely manner. Since the sample was already 30 days past the holding period it was not re-extracted.

Appendix 4b. (Continued)									
Site	Date	Time	EPTC (Eptam)	Simazine	Carbaryl	Metolachlor	Cyan-azine	Dacthal (DCPA)	Methid-athion
Mid Roberts Island Drain	19-Feb-05	12:40	ND	1.200	ND	0.190	ND	ND	ND
Mosher Slough at Mariner's Dr	15-Feb-05	12:30	ND	(0.180 J)	0.100	(0.012 J)	ND	ND	ND
Mosher Slough at Mariner's Dr	16-Feb-05	13:10	ND	(0.079 J)	0.073	ND	ND	ND	ND
Mosher Slough at Mariner's Dr	17-Feb-05	16:40	ND	BLB (0.071 J)	BLB 0.033	BLB 0.021	ND	ND	BLB (0.018 J)
Mosher Slough at Mariner's Dr	18-Feb-05	15:10	ND	(0.074 J)	0.045	(0.010 J)	ND	ND	ND
Mosher Slough at Mariner's Dr	19-Feb-05	15:40	ND	(0.140 J)	0.047	(0.007 J)	ND	ND	ND
Ulati Creek at Brown Rd	15-Feb-05	16:40	ND	(0.073 J)	ND	ND	ND	ND	ND
Ulati Creek at Brown Rd	16-Feb-05	9:50	ND	4.400	0.023	0.026	ND	ND	ND
Ulati Creek at Brown Rd	17-Feb-05	9:40	ND	BLB 3.200	ND	BLB 0.023	ND	ND	ND
Ulati Creek at Brown Rd	18-Feb-05	8:50	ND	1.600	ND	(0.016 J)	ND	ND	ND
Ulati Creek at Brown Rd	19-Feb-05	9:10	ND	1.500	ND	0.030	ND	ND	ND

Appendix 4c. San Joaquin pesticide results (excluding diazinon and chlorpyrifos).

(Concentrations are in units of µg/L. ND: Not detected; J: estimated value; CJ: analyte concentration was in excess of the instrument calibration and is considered estimated; B: biased low due to low surrogate recovery in sample; BLB: biased low due to low surrogate recovery in associated lab blank or lab spike (see Appendices 5 & 6 for details). Each sample was also analyzed for proparigate and azinphos methyl which were not present at detectable levels).

Site	Date	Time	Eptam (EPTC)	Simazine	Carbaryl	Metolachlor	Bifenthrin	Cyan-azine	Dacthal (DCPA)	Methid-athion
Stanislaus River at Caswell State Park	27-Jan-05	07:00	ND	0.860	ND	ND	ND	ND	(0.009 J)	0.031
Stanislaus River at Caswell State Park	27-Jan-05	11:50	ND	0.520	ND	ND	ND	ND	ND	(0.018 J)
Stanislaus River at Caswell State Park	28-Jan-05	06:50	ND	0.390	0.100	ND	ND	ND	ND	ND
Stanislaus River at Caswell State Park	28-Jan-05	11:20	ND	0.480	0.058	ND	ND	ND	ND	(0.010 J)
Stanislaus River at Caswell State Park	29-Jan-05	08:30	ND	0.370	(0.016 J)	ND	ND	ND	ND	(0.010 J)
Stanislaus River at Caswell State Park	29-Jan-05	13:00	ND	0.460	(0.011 J)	ND	ND	ND	ND	ND
Stanislaus River at Caswell State Park	30-Jan-05	10:40	ND	0.250	ND	ND	ND	ND	ND	ND
Stanislaus River at Caswell State Park	30-Jan-05	15:30	ND	0.330	ND	ND	ND	ND	ND	ND
Stanislaus River at Caswell State Park ¹¹	15-Feb-05	06:40	ND	BL (0.14 J)	ND	ND	ND	ND	ND	ND
Stanislaus River at Caswell State Park ¹²	15-Feb-05	11:30	ND	0.230	ND	ND	ND	ND	ND	ND
Stanislaus River at Caswell State Park	16-Feb-05	07:40	ND	0.320	(0.007 J)	(0.009 J)	ND	ND	(0.011 J)	ND
Stanislaus River at Caswell State Park	16-Feb-05	12:10	ND	0.310	(0.014 J)	ND	ND	ND	ND	ND
Stanislaus River at Caswell State Park	17-Feb-05	06:30	ND	0.260	ND	ND	ND	ND	ND	ND
Stanislaus River at Caswell State Park	17-Feb-05	11:00	ND	0.350	0.022	ND	ND	ND	ND	ND
Stanislaus River at Caswell State Park	18-Feb-05	06:50	ND	BLB 0.320	BLB (0.019 J)	ND	ND	ND	ND	ND
Stanislaus River at Caswell State Park	18-Feb-05	11:20	ND	BLB 0.360	ND	ND	ND	ND	ND	ND
San Joaquin River at Vernalis	27-Jan-05	07:40	ND	(0.11 J)	ND	ND	ND	ND	ND	ND
San Joaquin River at Vernalis	27-Jan-05	12:20	ND	0.220	ND	ND	ND	ND	ND	(0.013 J)
San Joaquin River at Vernalis	28-Jan-05	07:20	ND	(0.11 J)	ND	ND	ND	ND	ND	ND
San Joaquin River at Vernalis	28-Jan-05	11:50	ND	(0.11 J)	0.033	ND	ND	ND	ND	ND
San Joaquin River at Vernalis	29-Jan-05	09:00	ND	0.150	ND	ND	ND	ND	ND	(0.016J)
San Joaquin River at Vernalis	29-Jan-05	13:30	ND	0.160	ND	ND	ND	ND	ND	ND
San Joaquin River at Vernalis	30-Jan-05	11:10	ND	0.600	ND	ND	0.030	ND	ND	ND
San Joaquin River at Vernalis	30-Jan-05	16:10	ND	0.620	ND	ND	ND	ND	ND	ND

¹¹ This sample had a surrogate recovery of 50%. The sample should have been re-extracted and re-analyzed. The laboratory through scheduling problems failed to re-extract the sample in a timely manner. The scheduling of sample re-extractions was changed to facilitate timely re-extractions. Since the sample was over 30 days past the holding time the sample was not re-extracted.

¹² This sample had a slightly low surrogate recovery of 77%. The sample was re-analyzed on 23 March. The surrogate recovery was 90% meeting the QAPP acceptance limits.

Appendix 4c. (Continued)

Site	Date	Time	Eptam (EPTC)	Simazine	Carbaryl	Metolachlor	Bifenthrin	Cyan-azine	Dacthal (DCPA)	Methid-athion
San Joaquin River at Vernalis	15-Feb-05	07:20	ND	(0.074 J)	ND	(0.009 J)	ND	ND	ND	ND
San Joaquin River at Vernalis	15-Feb-05	12:10	ND	(0.062 J)	ND	(0.010 J)	ND	ND	ND	ND
San Joaquin River at Vernalis	16-Feb-05	08:20	ND	(0.075 J)	ND	(0.014 J)	ND	ND	ND	ND
San Joaquin River at Vernalis	16-Feb-05	12:50	ND	(0.098 J)	ND	0.021	ND	ND	ND	ND
San Joaquin River at Vernalis	17-Feb-05	07:10	ND	0.320	ND	0.030	ND	ND	ND	ND
San Joaquin River at Vernalis	17-Feb-05	11:30	ND	(0.150 J)	ND	(0.016 J)	ND	ND	ND	ND
San Joaquin River at Vernalis	18-Feb-05	07:30	ND	BLB 0.420	ND	BLB (0.012 J)	ND	ND	ND	ND
San Joaquin River at Vernalis	18-Feb-05	11:50	ND	BLB 0.030	ND	BLB (0.011 J)	ND	ND	ND	ND
Tuolumne River at Shilo Road	27-Jan-05	08:20	ND	(0.120 J)	(0.016 J)	ND	ND	ND	ND	0.068
Tuolumne River at Shilo Road	27-Jan-05	13:00	ND	(0.100 J)	0.027	ND	ND	ND	ND	(0.030 J)
Tuolumne River at Shilo Road	28-Jan-05	08:00	ND	(0.140 J)	ND	ND	ND	ND	ND	ND
Tuolumne River at Shilo Road	28-Jan-05	12:40	ND	(0.150 J)	ND	ND	ND	ND	ND	ND
Tuolumne River at Shilo Road	29-Jan-05	09:20	ND	0.830	ND	(0.014 J)	(0.013 J)	ND	ND	0.037
Tuolumne River at Shilo Road	29-Jan-05	14:00	ND	0.650	ND	ND	ND	ND	ND	(0.022 J)
Tuolumne River at Shilo Road	30-Jan-05	11:50	ND	1.200	ND	ND	ND	ND	ND	ND
Tuolumne River at Shilo Road	30-Jan-05	16:30	ND	1.100	ND	ND	ND	ND	ND	ND
Tuolumne River at Shilo Road ¹³	15-Feb-05	08:00	ND	(0.050 J)	ND	ND	ND	ND	ND	ND
Tuolumne River at Shilo Road	15-Feb-05	12:50	ND	(0.036 J)	ND	ND	ND	ND	ND	ND
Tuolumne River at Shilo Road	16-Feb-05	09:00	ND	(0.044 J)	ND	ND	ND	ND	ND	ND
Tuolumne River at Shilo Road	16-Feb-05	13:20	ND	(0.100 J)	ND	ND	ND	ND	ND	ND
Tuolumne River at Shilo Road ¹⁴	17-Feb-05	07:40	ND	CJ 1.800	ND	ND	ND	(0.008 J)	ND	(0.021 J)
Tuolumne River at Shilo Road	17-Feb-05	12:10	ND	1.100	ND	ND	ND	ND	ND	ND
Tuolumne River at Shilo Road	18-Feb-05	08:00	ND	BLB 0.210	ND	ND	ND	ND	ND	ND
Tuolumne River at Shilo Road	18-Feb-05	12:20	ND	BLB (0.160 J)	ND	ND	ND	ND	ND	ND
Merced River at River Road ¹⁵	27-Jan-05	09:20	ND	(0.031 J)	ND	ND	ND	ND	ND	ND
Merced River at River Road	28-Jan-05	08:50	ND	1.800	ND	ND	ND	ND	ND	ND

¹³ This sample had a slightly low surrogate recovery of 76%. The sample was re-analyzed on 23 March. The surrogate recovery was 94% meeting the QAPP acceptance limits.

¹⁴ This sample had a Simazine value above the highest standard used by the CDFA lab. The dilution was overlooked and the sample extract dried out. The value reported for Simazine is an estimated concentration.

¹⁵ This sample had a slightly low surrogate recovery of 74%. The sample was re-analyzed on 23 March. The surrogate recovery was 93% meeting the QAPP acceptance limits.

Appendix 4c. (Continued)

Site	Date	Time	Eptam (EPTC)	Simazine	Carbaryl	Metolachlor	Bifenthrin	Cyan-azine	Dacthal (DCPA)	Methid-athion
Merced River at River Road	29-Jan-05	10:30	ND	0.690	ND	ND	ND	ND	ND	ND
Merced River at River Road	30-Jan-05	13:00	ND	1.700	ND	ND	ND	ND	ND	ND
Merced River at River Road	15-Feb-05	09:20	ND	(0.019 J)	ND	ND	ND	ND	ND	ND
Merced River at River Road	16-Feb-05	10:20	ND	(0.016 J)	ND	ND	ND	ND	ND	ND
Merced River at River Road	17-Feb-05	08:50	ND	(0.024 J)	ND	ND	ND	ND	ND	ND
Merced River at River Road	18-Feb-05	09:20	ND	BLB 0.510	ND	ND	ND	ND	ND	ND
San Joaquin River at Lander Avenue	27-Jan-05	09:50	ND	(0.063 J)	ND	(0.008 J)	(0.007 J)	ND	ND	ND
San Joaquin River at Lander Avenue	28-Jan-05	09:20	ND	(0.110 J)	(0.014 J)	ND	ND	ND	ND	ND
San Joaquin River at Lander Avenue	29-Jan-05	11:00	ND	0.110	(0.007 J)	ND	ND	ND	ND	ND
San Joaquin River at Lander Avenue	30-Jan-05	13:20	ND	0.160	ND	ND	ND	ND	ND	ND
San Joaquin River at Patterson	15-Feb-05	08:40	ND	(0.010 J)	ND	0.022	ND	ND	ND	ND
San Joaquin River at Patterson	16-Feb-05	09:40	ND	(0.083 J)	ND	0.061	ND	ND	ND	ND
San Joaquin River at Patterson	17-Feb-05	08:10	ND	0.260	ND	0.032	ND	ND	ND	ND
San Joaquin River at Patterson	18-Feb-05	08:40	ND	BLB 0.220	ND	BLB 0.023	ND	ND	ND	ND

Appendix 5. Lab Blank Data

(No pesticides were present at detectable levels. The pesticides include azinphos methyl, bifenthrin, carbaryl, chlorpyrifos, cyanazine, diazinon, dacthal (DCPA), EPTC (Eptam), metolachlor, methidathion, propargite, simazine)

Date Extracted	Chlorpyrifos Methyl (Surrogate) Recovery
1/28/2005	88%
2/1/2005	95%
2/1/2005	98%
2/16/2005	80%*
2/17/2005	91%*
2/17/2005	96%
2/18/2005	81%
2/22/2005	68% ¹⁶
2/22/2005	73% ¹⁷
2/23/2005	93%
2/24/2005	92%
2/25/2005	88%
2/28/2005	89%
3/1/2005	85%
* Re-injection	

¹⁶ The surrogate recovery (68% recovery) was outside of the acceptable range for recovery (80-125%) as defined in the QAPP. A re-analysis yielded similar (66%) results. No compounds were detected above the lab MDL. The low recovery was probably due to loss during the concentration step of the extraction procedure. The Lab spike, all samples and matrix spikes had surrogate recoveries within the acceptance criteria. No further action taken by the laboratory.

¹⁷ The surrogate recovery (73% recovery) was outside of the acceptable range for recovery (80-125%) as defined in the QAPP. The low recovery was likely due to an extraction error of not adding salt to the deionized water used for making blanks and spikes. The omission of salt gives the sample a matrix that is different than that of river water. A clean water sample without added matrix gives recoveries since standards are prepared to match the matrix of a river water sample. All surrogate recoveries in the actual samples associated with this QC set were within the acceptance limits of 80 - 125%. The associated batch of samples were all of the samples collected in the San Joaquin Basin on 18 February 2005 and the samples collected from the Feather River, Sacramento Slough (including a duplicate) and the Sacramento River at Veteran's Bridge on 17 February 2005.

Appendix 6. Recovery of lab spikes and surrogates

Date Extracted	Diazinon	Chlorpyrifos	Bifenthrin	Surrogate
1/28/2005	98%	91%	91%	94%
2/1/2005	101%	92%	97%	100%
2/1/2005	93%	86%	97%	84%
2/16/2005	103%*	80%*	NR	80%*
2/17/2005	102%	86%	NR	81%
2/17/2005	100%	82%	NR	97%
2/18/2005	111%	90%	NR	90%
2/22/2005	91%	81%	NR	90%
2/22/2005	75% ¹	69% ¹	NR	66% ¹
2/23/2005	107%	106%	NR	100%
2/24/2005	99%	92%	NR	96%
2/25/2005	96%	83%	NR	92%
2/28/2005	100%	91%	NR	94%
3/1/2005	94%	93%	NR	88%
* Re-injection				

¹ The low spike and surrogate recoveries were likely due to an extraction error of not adding salt to the deionized water used for making blanks and spikes. The omission of salt gives the sample a matrix that is very different from that of river water. A clean water sample without added matrix gives recoveries since standards are prepared to match the matrix of a river water sample. All surrogate recoveries in the actual samples associated with this QC set were within the acceptance limits of 80 - 125%. The associated batch of samples was collected in the Delta on 17 February 2005.